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Machining and Molding Cast Tunnel Linings

Special Machinery Employed in the Manufacture of the Segments for the Tubes Now Being Bored Under the East River

BY LOUIS J. JOSTEN

The manufacture and inspection of the cast-iron tunnel rings for the New York subway system for the East River crossings between Whitehall Street, Manhattan and Montague Street, Brooklyn, are now in progress at the works of the New York Car Wheel Company, Buffalo, N. Y. The contract calls for approximately 40,000 tons of segments, to be delivered at the rate of 50 to 150 tons a day as required. On the completion of this tunnel and the Old Slip-Clark Street tunnel, which is also under construction, there will be twenty-one subaqueous cast-iron tunnel-lined tubes in the United States. Two are under the St. Clair River, thirteen under the East River and six under the Hudson River. The following table enumerates all the important subaqueous tunnels built in this country in the order of their completion.

Name of Tunnel	No. of Tubes	Completed	Constructed Under	Chief Engineer
Saint Clair	2	1891	St. Clair River	Joseph Hobson
East River Gas	1	1894	East River	Chas. M. Jacobs
Hudson & Manhattan	2	1905	Hudson River	Jacobs & Davies
Pennsylvania	2	1906	Hudson River	Chas. M. Jacobs
Pennsylvania	4	1907	East River	Alfred Noble
Hudson & Manhattan	2	1907	Hudson River	Jacobs & Davies
Battery	2	1908	East River	Wm. Barclay Parsons
Queensboro	2	1915	East River	R. A. Shailer
Whitehall-Montague	2	....	East River	Alfred Craven
Old Slip-Clark St	2	....	East River	Alfred Craven

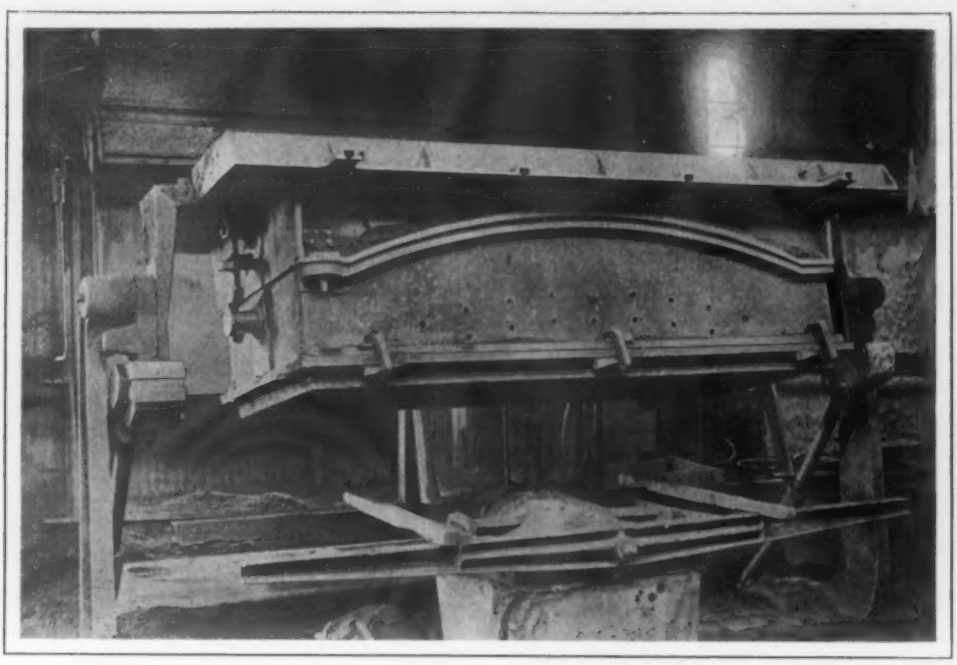
These tunnels are admittedly marvelous accomplishments as great pieces of engineering, but the foundries in supplying the tunnel plates are equally worthy of special recognition, as their product required the most exacting manipulation of material and machinery, besides the utmost discrimination in successfully meeting the extraordinary demands of the contract, and this success secured a great distinction for the New York Car Wheel Company, Buffalo, N. Y., that furnished a large percentage of the cast-iron lining used in the construction of these tunnels.

The Molds Ready for the Pouring

The various diameters and sections used in the construction of the Whitehall-Montague tunnels are given in the following table. The heavy segments with 9-in. flange are used in the earth formation and the light segments with 7-in. flange in rock formation. These rings are all designed on the same principle and are composed of a number of segments with radial joints except for a key which tapers in the opposite direction to facilitate erection. Each ring is composed of nine segments and a key and is 26 in. long, except the special 23-ft. 9-in. flange ring, which is composed of eleven segments and a key 30 in. long.

Diameter, Ft.-In.	Flange, In.	Weight of Complete Ring, Lb.
17-2	7	8,255
18-0	7	8,798
18-0	9	13,700
23-0	9	14,753

Special taper rings are also required in connection with the regular straight rings. The special taper rings are similar to the regular ones except that they are wider on one side than the other and are required for all the different types of linings to correct the deviations in line and grade and to pass around curves both vertical and horizontal. The rings are designed in two styles, symmetrical and non-symmetrical. In the latter case all the taper is carried on one side of the ring, while in the symmetrical the taper is divided equally between the two faces. The taper machined in these rings is effected by changing the thickness of the flanges in the segments or by altering the width of the web between the two circumferential flanges. They are ordered in three sizes: ¾, 1½ and 2¼ in., meaning that the rings have the same width as a standard, straight ring on one side, the width on the other side being increased by ¾, 1½ or 2¼ in., as the case may be.



Lifting and Turning the Table with the Mold Attached After Jolting

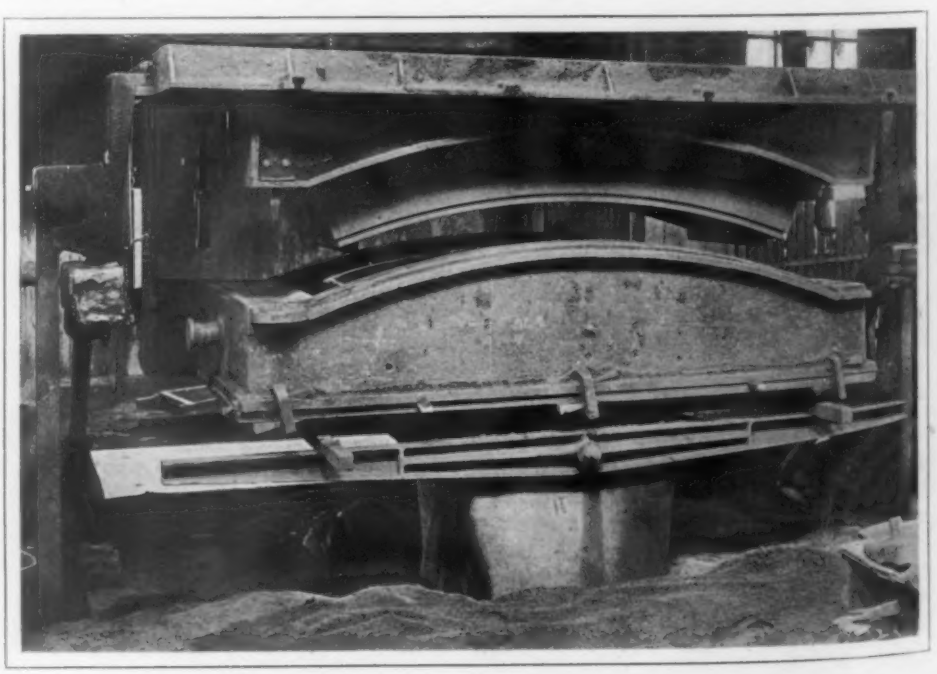
Great precaution has to be taken in bidding on this class of work, a most searching investigation has to be made to ascertain approximately what is contained in the contract, as the tonnage of iron is taken at a unit price of so much per ton. In this total tonnage the light sections in rock, the heavy sections in earth, the different diameters and the special taper rings are all included. No extra compensation of any kind is allowed for the various rings, nor are itemized statements furnished as to the quantity of each.

The New York Car Wheel Company has been engaged in the manufacture of chilled carwheels for the past thirty years, making wheels from 6 to 43 in. in diameter for service in industrial railroad work, steam and electric railroad service, also double flange wheels for electric crane service and chilled castings in general. It has been manufacturing tunnel segments for the past ten years, its first order being given by the Pennsylvania Railroad Company in 1905. Various other tunnel contracts have since been taken from time to time, the cores being made and molded by hand up to the present contract, which are all made by machine, both molds and cores. The plant is situated on the shore of the canal, by which the segments are shipped as long as navigation is open to New York City by boat. It is remarkable to note that these boats make the round trip from Buffalo to New York City in one week.

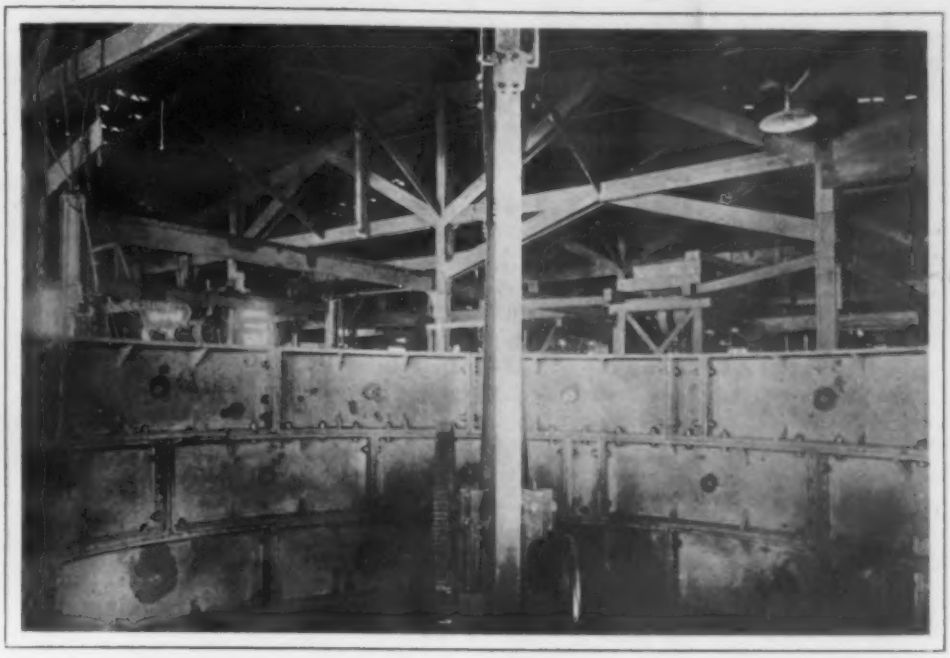
The equipment used, including patterns, core-boxes and core-prints, are all made of metal, thereby insuring the last mold and core as accurate as the first. In obtaining this contract the New York Car Wheel Company expended nearly $50,000 for improvements for handling and making these castings. The present New York subway tunnels are the first segments made by machine, and from close observation the machine-molded segments are a success, not only as to the quality and quantity of molds produced, but also on account of labor conditions as no experienced molders are required to operate the machines, the only skilled molders employed being those engaged in setting the cores and building up the runner basins.

The building in which the segments are molded and cast is one especially erected for this purpose, being an addition built on the side of the main foundry in which the wheels are made. This building is equipped with three overhead traveling cranes, two jib cranes, two Herman jolt machines for making the drags and one for making copes and the conveying outfit, which carries the sand to two large hoppers placed directly over the drag machines.

The molten iron is brought in large crane ladles on buggies from the main foundry, which has two cupolas capable of furnishing 350 tons of iron daily. The quality of the iron used in the castings is determined by the "Arbitration Bar," which has to withstand a minimum breaking strength under a transverse load of 3000 lb., a deflection of not less than 0.10 in. and a chemical analysis of not more than 0.6 per cent phosphorus and not more than 0.12 per cent sulphur.



The Mold Receiving Table Lowered and the Pattern Drawn

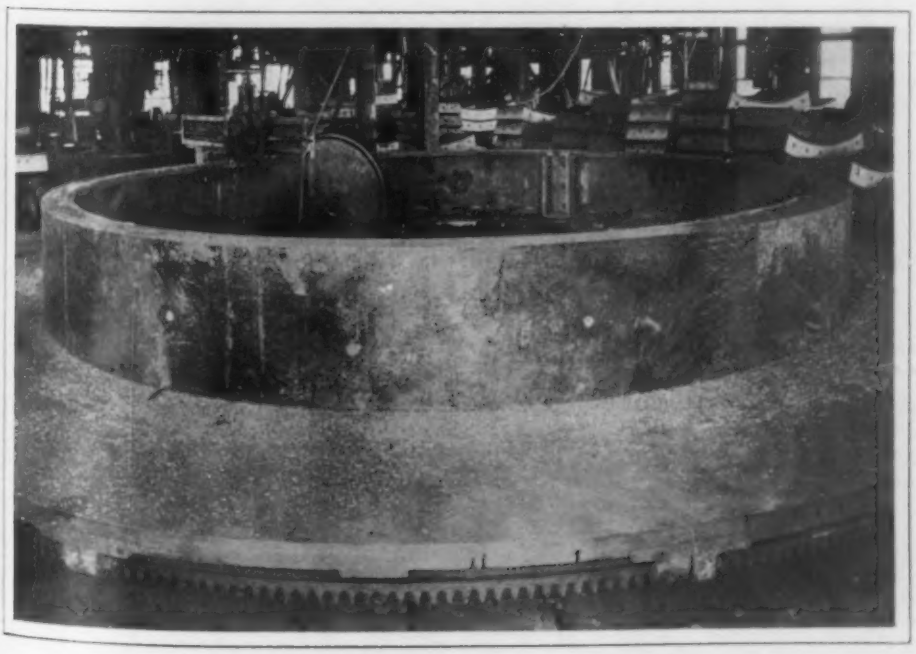


Three Rings Assembled in a Horizontal Position to Determine Accuracy of Machining

In making the drag mold a wooden hopper 6 in. deep is placed across the flask as a sand guide, sand is now thrown in the flask even with the hopper, the machine is next jolted the required number of jolts, which is usually 80 blows, to give the density of the mold required, the sand is then struck off and the bottom board is placed in position and clamped. This board should be of sufficient thickness to prevent sagging of the mold in the flask, which is a common occurrence of poorly designed bottom boards in this class of work. The table with the mold is then lifted and turned as shown. It will be seen here that the follow board is securely fastened to the table of the machine and the flask in turn is fastened to the follow board, this arrangement giving the maximum jarring effect. After the machine table is turned over to the drawing position, which is directly over the mold receiving table, this table is moved upward by air until the mold rests upon it. The two hooks on each side of the flask which hold the flask securely to the follow board are now unfastened, the vibrator is then put into action, which loosens the pattern from the mold, and while the vibrator is in use the mold receiving table is lowered and the pattern drawn from the mold. No venting of the mold is necessary as dependence can be placed on the porosity of the molding sand. The mold is gated in the center of the circumferential flanges. The machine table with the follow board and pattern is next swung back in place to jar another mold. The mold is then taken from the receiving table by a crane to the pouring floor to have the cores set.

The copes are made upon a plain jolt machine with a follow board of a curvature of one-half the diameter of the outside of the ring. The curvature of the flask is to match. After the mold is jolted the molder builds the runner basin for pouring. The cope machine is capable of turning out a greater number of molds in the same length of time than the drag machine and for this reason two drag machines were installed. The side cores required for the mold are also made by machine and the end cores forming the five bolt holes and bosses are made by hand in one piece. The side cores are nailed so as to prevent floating. The bolt holes in both the circumferential and longitudinal flanges are cored ¼ in. larger than the shank of the bolt used in erection.

The machine shop at the New York Car Wheel Company contains three specially constructed side milling machines, one end milling machine and a machine for finishing the special taper rings. These machines were all built by this company ten years ago when it received the first order from the Pennsylvania Railroad. At the present time it is not necessary to construct any special side or end milling machines as there are various types on the market suitable for this class of work. The only machine, even of today, that would require special construction is that for machining the taper rings. The machine designed and constructed by the New York Car Wheel Company for machining taper rings consists of a revolving table running on 2-in. ball bearings. The table is made to revolve from a driving gear



Machining the Taper Rings with a Special Machine

meshed into the rack of the table and has numerous slots for clamping. It is made large enough to machine rings from 16 to 23 ft. in diameter and is built up in sections. The table is made to revolve between the cross-head and slide of an ordinary planing machine.

The individual segments for a taper ring are first machined on one side of the circumferential flange on the side milling machine. After they are finished they are run through the end milling machine to machine both the longitudinal flanges. The key is also put through this same operation. The segments and the key are then bolted up in a complete ring with the machined side next to the revolving table of the taper machine. After this is done the ring is wedged up to the proper height and the taper machined in it, the ring being held securely to the revolving table by bolts and clamps.

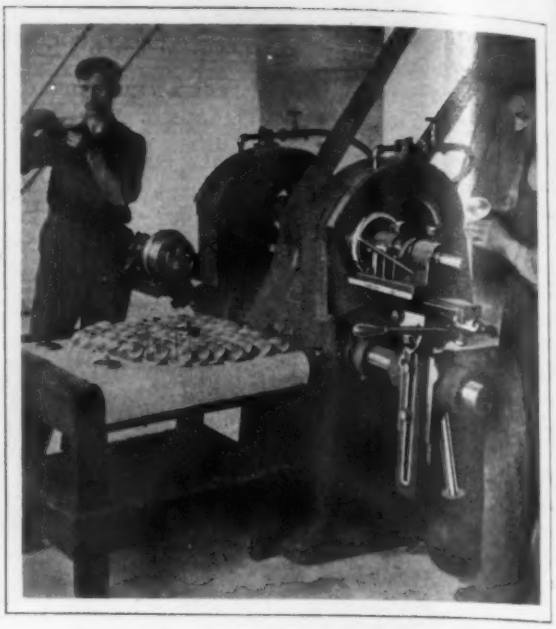
The regular straight segments are first run through the side milling machine to mill both circumferential flanges at the same time, and after that both longitudinal flanges are milled on the end milling machine. From time to time as the engineer or inspector deems it necessary three rings are ordered to be assembled in a horizontal position as shown, under which conditions the faces of the rings thus bolted up shall be true surfaces. The outer edge of the face of any ring must not vary anywhere more than ½ in. from a true circle, nor shall the circumference vary more than ½ in. in any ring. The rings ordered assembled at the shop are erected by the broken joint method the same as in the construction of the tunnel. By this method of construction where the adjoining segments span the joints, a rigid circular section is insured. It is absolutely necessary that all similar segments, except taper rings, must be of such uniformity in dimensions that they will be interchangeable with each other and with similar segments of other rings of the same type. The spacing of the bolt holes must be so accurate that any two rings can be bolted in any relative position.

The machine shop must be equipped to machine a maximum capacity of approximately 144 segments a day and 16 keys. This amount is based upon the amount of rings that are erected in each heading, which is usually 3 to 4 rings a day. As these tunnels are driven from both shores of the river at the same time, four headings will be in operation. For this reason the foundry furnishing the segments, if it has the entire contract, must have such capacity to keep these four headings supplied when in full operation.

Grinding Gas Plugs for Shrapnel Shells

Charles H. Besly & Co., Chicago, Ill., have adapted their grinding machines for a number of operations on shrapnel and high-explosive shells. Among the work handled by these machines is the finishing of the inner face of base plates or gas plugs for high-explosive shells, removing the stub ends left for centers on 3-in. shrapnel shells and also facing the ends of both shrapnel and high-explosive shells. In facing the gas plugs a special chuck is used for holding the piece while for the other work the shells are dropped into a circular recess in the workholder on the table and backed up by an angle plate.

The grinding is done by vitrified ring wheels held in a pressed steel chuck. These wheels are 16 in. in diameter and 4 in. deep when new and may be worn down to 1 in. in depth before being discarded, as the wheel can be set out in the chuck

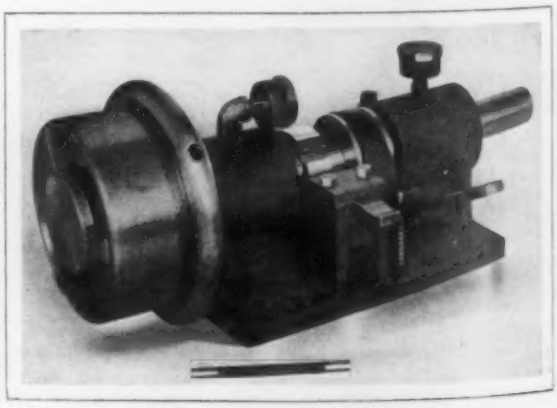


A Double-Spindle Grinding Machine Equipped with a Special Rotary Chuck for Finishing Gas Plugs or Base Plates for High-Explosive Shells

from time to time. The action of the grinding wheel rotates the work while the grinding of the gas plugs is being done. The plugs are threaded and the inner face roughed off in a screw machine. The special rotary chuck used has three jaws threaded to engage the threads on the plug and where unthreaded beveled base plates or gas plugs are to be ground unthreaded beveled jaws are substituted. The output of these machines is 60 to 80 plugs an hour for each operator depending upon the amount of stock to be removed.

These machines are also supplied with workholders for facing the ends of high-explosive shells having a maximum diameter of 4.5 in. after the base plate or gas plug has been inserted in the shell and the square projection on the plate removed by sawing, twisting or grinding. After this has been done a maximum of 1/16 in. of stock remains to be ground from the rear face of the gas plug, which is 3⅜ in. in diameter, to make it flush with the base of the shell. The hourly output on this work is from 15 to 40 shells for each operator, depending on the amount of stock to be removed.

The machine employed is of the double-spindle type with oscillating geared lever feed work tables, the spindle being 2 in. in diameter and running in inserted renewable bushings. Hardened and ground tool steel thrust collars are provided to take the end thrust. All parts subject to wear are renewable and provision is made to compensate for wear. A



The Special Rotary Chuck with Three Threaded Jaws for Gripping the Gas Plugs while the Inner Face Is Being Ground

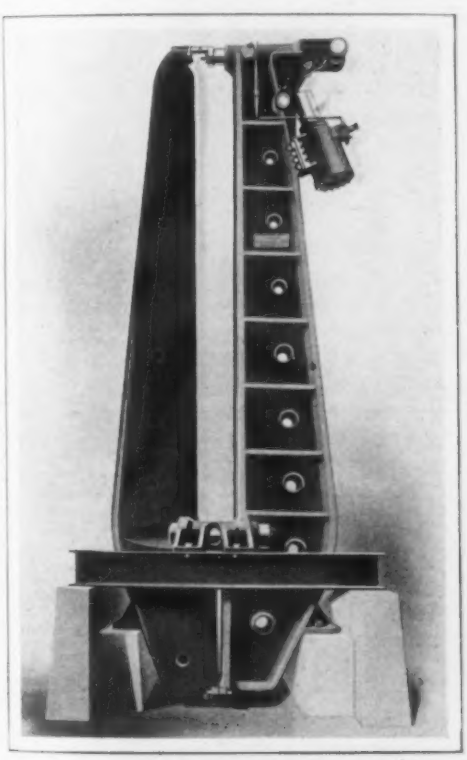
leverage of 20 to 1 is provided for the geared lever feed table. The machine is equipped with water hoods and piping.

When used for removing the stub ends left for centers on the shells workholders with a circular recess are provided. The hourly output of this machine on 3-in. shrapnel shells is 200 pieces.

A 21-Ft. Pneumatic Riveting Machine

What are believed to be the two largest pneumatic riveting machines ever constructed have been built by the Hanna Engineering Works, 2059 Elston Avenue, Chicago, Ill. The machines have a reach of 21 ft. and are designed to exert a pressure of 100 tons on a rivet die with an air pressure of 100 lb. It is pointed out that by installing a pressure regulating valve in the air supply line, the air pressure at the cylinder can be changed quickly to vary the pressure on the rivet dies to produce the tonnage considered best by the operator for the size of rivet being driven.

This machine, which weighs 40 tons, is the same in its general design and operation as the one which



A Pneumatic Riveting Machine Having a Reach of 21 Ft. and Capable of Exerting a Pressure of 100 Tons on the Rivet Die

was illustrated in THE IRON AGE, April 8, 1915. In this machine toggles, levers and guide links are combined to give the large opening of the toggle joint movement with its gradually increasing pressure until the desired point is reached, after which there is a simple lever movement through a considerable space under approximately maximum pressure. The cylinders of these machines have a piston stroke of 22 in. corresponding to a travel of the rivet die of 5¾ in. The toggle action takes place during the first part of the piston travel which represents approximately 4¾ in. of the die travel. At this point the mechanism changes automatically into a simple lever action without a critical point, and for every inch of the last 11 in. of piston travel the rivet will move forward 1/11 in. or a total of 1 in. over the last part of the piston travel. This arrangement eliminates any necessity of extremely careful adjustment of the die screw on account of the relatively large distance through which the rated pressure is exerted. There is also no necessity for striking a rivet more than once as the rivet is set with a predetermined pressure at each blow.

While the lever action is taking place the die moves slowly, thus tending to provide time for the metal in the rivet to flow and to fill the hole completely in addition to giving an opportunity for the rivet to set before the pressure is entirely released on the return part of the lever action. For this reason it is also possible to drive cold rivets due to the automatic slowing up of the motion which gives the metal time to flow.

Controlling Rio Grande Flood Waters

Reference was made in THE IRON AGE of Sept. 16, page 667, to the work of C. F. Z. Caracristi as special consulting engineer of the International Boundary Commission and the Santa Helena international dam in the Grand Canyon of Santa Helena (not Lajitas Canyon), Rio Grande River. This project will control 60 per cent of the flood waters of the Rio Grande and make the boundary permanent. The United States Government alone has spent $800,000 in the past 40 years in studying this work, but the engineers failed to look for the flood area, which is in the Sierra Madre in Mexico, the flood waters reaching the Rio Grande through the Rio Conchos, Mexico. The Mexican engineers in a like period spent $400,000. Thus the two countries jointly expended $1,200,000 on useless maps and official positions without reaching any practical result. As soon as boundary line maps were made—in fact, often before they were even compiled—the river would rise and this country would exchange territory with Mexico over night and the survey would be useless. The reservoir as projected will hold 13,600,000 acre ft. of water and in addition have a reserve capacity to be used in case of accident to the Elephant Butte dam in New Mexico and the Conchos dam in old Mexico, of an additional 5,400,000 acre ft. This is done to protect the lower Rio Grande Valley. It will be by far the largest reservoir in America. The whole project will go before Congress as a part of the commission's report next December.

Radiation Pyrometers

The Bureau of Standards has issued a bulletin, No. 250, on "Characteristics of Radiation Pyrometers," by George K. Burgess and Paul D. Foote. It discusses the principles of radiation pyrometry, considering mainly the various types of radiation instruments, their calibration, sources of error, including the various factors which may influence their indications, and their adaptability to the measurement of temperatures. It is shown that when suitably designed, adequately calibrated and correctly used there are several trustworthy instruments of this type having many practical advantages, while it is also made clear that the radiation pyrometer is subject to many influences which may seriously limit the accuracy of its readings unless proper precautions are taken. In all some twenty instruments are examined, including the Féry, Foster, Thwing and Brown pyrometers.

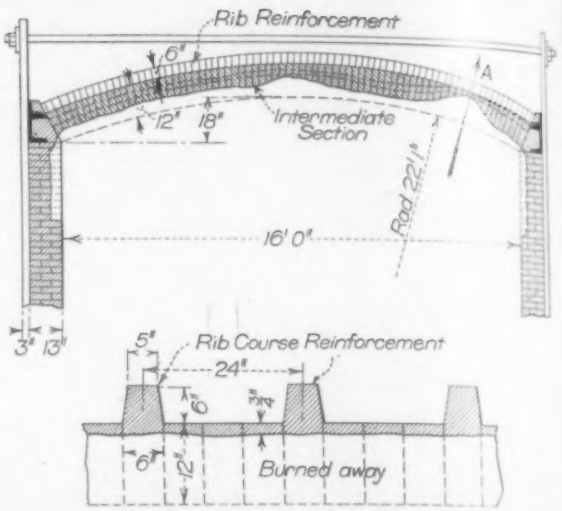
The Timken Chicago office has been removed to 1335 Peoples Gas Building. This office, which is in charge of P. W. Hood, as Western representative of the Timken Roller Bearing Company and the Timken-Detroit Axle Company, was formerly at 1347 South Michigan Boulevard, which had come to be regarded as too far from the business center.

As illustrating the far-reaching effects of the heavy demand for war supplies, it is mentioned that the Wenatchee Valley Box Agency, in eastern Washington, has recently closed a contract for thirty carloads of boxes for use in shipping shrapnel.

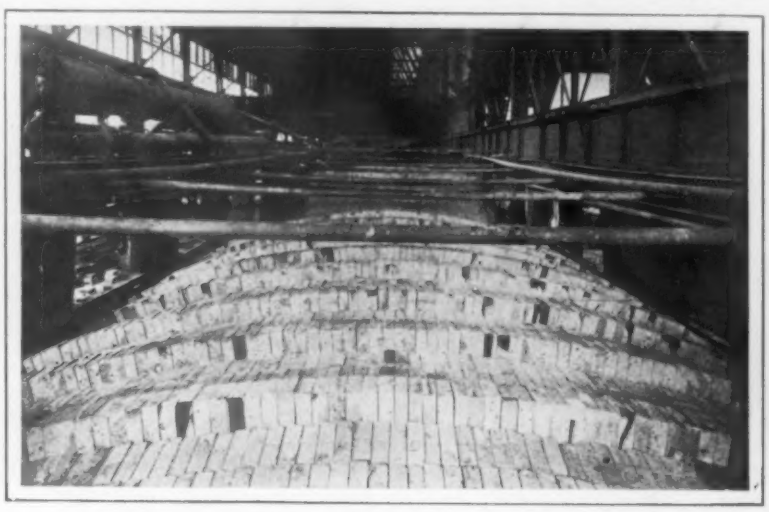
OPEN-HEARTH FURNACE ROOF

Orth Rib Type and the Better Furnace Production Resulting—Patching Eliminated

Mention was made in THE IRON AGE, July 29, 1915, of the considerable extension of service obtained from open-hearth furnace roofs through the use of the Orth method of reinforced construction. Citation was made at that time of an average production of 17,041 tons per roof increased to an average of 24,600 tons. Other reports show an average number of heats per roof increased from 387 with the ordinary construction to 537 with the reinforced roof. The securing of this larger production results from the retention of the open-hearth roof in service through the use of a system of reinforcement and repair beyond the point where, with ordinary construction, the burning away of the roof would have brought it to a condition of collapse. The design of the reinforced roof and the application of its advantages to operating practice are indicated in the accompanying drawings.

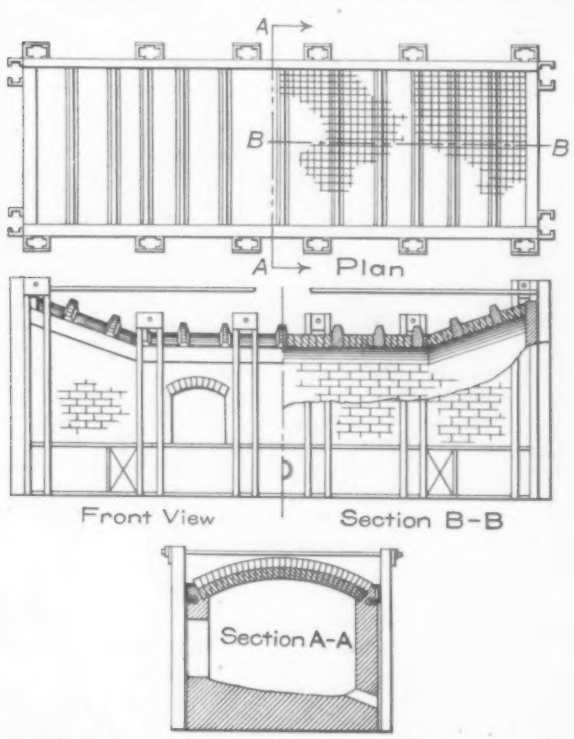


Cross-Sectional View Showing Typical Example of Roof Burning and Application of Rib Reinforcement



Top View of a Newly Built Furnace Roof with Ribbed Reinforcement

As indicated in the cross-sectional view, the arch is built, preferably, with ribs of special brick shapes having a depth usually from 3 to 6 in. greater than the regular roof brick. In some instances the construction is simplified to the point of alternating courses of 9 and 12 in. brick. These ribs, spaced at centers varying from 24 to 36 in., are relied upon to take practically all of the transverse thrust through the roof, also supporting, to a considerable extent, the intervening brick courses. With the furnace roof relieved of the function of supporting itself, the extent to which it may safely be permitted to be burned away, obviously, is increased. It is stated that the ordinary furnace roof must be replaced when no more than an average of 30 per cent of its thickness is burned away, largely for the reason that the burning of the roof is excessive in patches, developing thin spots over an area, which, though limited, endangers the entire roof. With the reinforced roof construction, the average burning away of the roof, it is claimed, is brought up to 60 per cent, and roofs have been continued in service when burned to a thickness of ¾ in. in the thin spots.

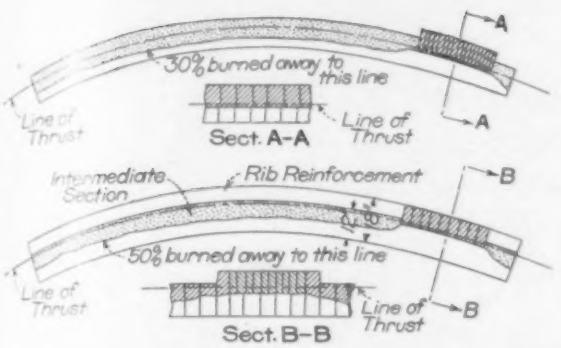


General View of Reinforced Arch Construction for Open-Hearth Furnace Roofs

The cross-section presents a typical example of how the roof burns out in spots, generally at points opposite the furnace doors, and the manner in which the very thin remaining section of the roof is carried by the rib courses. With the use of rib courses the line of thrust is raised with respect to the roof cross-section, so that with the roof burned out, even over a large area, there still remains the full resistance to crushing, up to the strength of the refractory material. With the larger exterior surface exposure of the refractory, due to the contour of the ribbed section of the roof, the maximum strength of the brick is more permanently effective. Tests made on samples of refractory taken from the upper portions of rib brick of discarded open-hearth roofs that had been through a full term of service, and having the same area as the remaining portions of rib courses at an ordinary thin spot in the roof, gave the following results:

	Sample 1	Sample 2
Effective area, sq. in.	34.1	34.1
Ultimate crushing load, lb. per sq. in.	3,285	3,675
Ultimate crushing load, total lb.	111,980	123,350

Speed of machine, 175 in. per min.



Former Method of Patching a Roof with the Later One Below

It is also to be noted that as the refractory burns away the remaining thickness of material increases in value, for the reason that radiation of heat from the brick is greater and its reduction retarded.

This method of reinforced construction also makes possible a system of repair, when it does become necessary, which, it is said, restores the original strength of the roof more effectively than is possible with ordinary methods of patching. The brick for the rib courses, in the most approved construction, is made with a slight draft, the brick being wider at the bottom. A wedging action is thus set up sufficient to support new roof brick securely when laid in over any area between two ribs. This repairing may be done over much larger areas at one time than is possible where in the common roof the strains set up by the expansion of any considerable area of new brick would wreck it, for the reason that the ribs not only separate the patched sections into smaller areas, but also take up the thrusts that are set up by the new brick as it becomes hot. It is also unnecessary, as may be readily understood, to cool down the furnaces to the point necessary in the repairing of common roofs, and in this fact alone a large saving is effected. The rib reinforcement is an essential factor in preserving a furnace roof when for any reason the furnace has to be cooled down and reheated again, an operation which with the ordinary roof not infrequently results in collapse. With the division of the roof into sections by reason of the rib construction, a small area of the roof may drop without affecting the remaining portions.

An additional feature included in the improved construction of the Orth roof has to do with the protection of the furnace binding. In the ordinary construction the burning away of the refractory at the junction of the roof and side walls of the furnace quickly exposes the channels which tie in the roof, with the result that they burn and are required to be replaced. As shown in one of the drawings the added height or thickness of brick afforded by reason of the presence of the rib courses permits a raising of the channels and a readjustment of the juncture of the roof brickwork with that of the side wall so that the thickness of refractory in front of the channel is greatly increased, prolonging the period of its protection correspondingly.

President F. A. Seiberling of the Goodyear Tire & Rubber Company, Akron, Ohio, recently addressed a meeting of Goodyear men at San Francisco by telephone. By arrangement with the American Telephone & Telegraph Company sixty-five Pacific coast representatives were assembled in the telephone exhibit theater at the Panama-Pacific Exposition. In the Akron office, 3000 miles away, sat a party of officers with telephone receivers clamped to the ears, while the San Francisco company were similarly equipped. The telephone conference lasted for 30 min.

Submarine Mining of Wabana Iron Ore

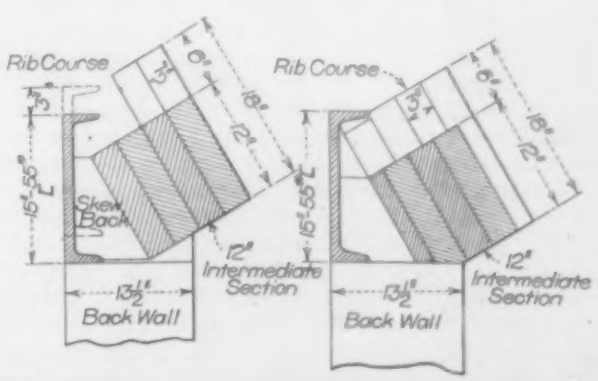
Iron ore reserves of 350,000,000 tons were estimated for the submarine deposits of the Wabana (Newfoundland) mines by Charles L. Cantley, assistant to the president of the Nova Scotia Steel & Coal Company, in an address before the New York Section of the Mining and Metallurgical Society of America, Thursday evening, Nov. 18. Mr. Cantley exhibited maps of the region and gave an interesting account of early operations. Iron ore was mined as early as 1815 and in 1850 to 1857 pig iron was made in that region which was regarded as excellent for cannon, much of it being shipped to England. Coke was made in 1840 and coal washers installed in the late eighteen-eighties. The Wabana deposits were discovered in 1895. They are 6 miles long and 2 miles wide and vary in thickness from 4½ to 14 ft. The average composition is 53 per cent iron, 7 to 9 per cent silica and 0.70 to 0.85 per cent phosphorus.

In describing the submarine deposits, which are separate from the land deposits on Bell Island and which are being worked by the Nova Scotia Steel & Coal Company through a land seam owned by the Dominion Iron & Steel Company, Mr. Cantley stated that developments so far bear out earlier estimates. The deposit extending out under the sea, which was discovered in 1905, apparently reaches out 12 to 15 miles on the major axis and 5 miles on the minor. Present operations extend 1 mile from the shore with the vein of ore averaging 30 ft. in thickness. The composition is remarkably uniform and of one grade, having not less than 50 per cent iron and under 10 per cent silica. The slope is 17 ft. in the clear, on which 80-lb. rails are laid, the power being all electric. About 900 men are employed.

Total shipments of iron ore from the district have averaged 1,500,000 tons per year, of which 1,000,000 tons has gone to Sydney, 250,000 tons to Europe and 250,000 tons to Philadelphia. Some 80,000 tons per year goes to Westphalia, Germany. Shipments have been made to Great Britain. That country is so wedded to the acid open-hearth process, the speaker said, that it prefers to use Norwegian and Spanish ores.

Fast steamers take the ore 400 miles seven months in the year to Sydney, Nova Scotia, where nine blast furnaces convert it into pig iron, the output averaging 450,000 to 500,000 tons per year. This is all made into steel in that district, nearly 300,000 tons of rails and 60,000 to 70,00 tons of wire and bars being produced. In the last six or seven months at least 3,000,000 shell forgings have been turned out.

The recent appointment of W. C. Dawson as Bolivian consul at Seattle, Wash., made by Ignacio Calderon, minister to the United States from Bolivia, as a result of the work of the Seattle Chamber of Commerce, places that city strongly in line to become an important tin-smelting center. The tin smelter of the Jamme syndicate, at South Seattle, built about a year ago to treat tin ore from Alaska, is being enlarged to care for the new business.



The Orth Method of Supporting the Furnace Roof in Which the Channel Is Raised to Minimize its Exposure. The Practice of the Illinois Steel Company at the Right

American Automatics to Rescue in France

The Shops of France Reorganized Through the Purchase of Production Screw Machines Under Direction of a Chicago Plant Foreman

BY O. J. ABELL

This is a story of Emerson's beaten path to the retreat of the specialist. In this case the path had its beginning in France and it ended on the fifth-floor, screw-machine department of the Felt & Tarrant Mfg. Company, Chicago. The specialist is William F. Carmody, foreman of the department. In the IRON AGE of Feb. 6, 1913, an article appeared dealing with the production of small parts on screw machines, being a description of some of the operations involved in the manufacture of the comptometer. The work described was being done on a battery of specially-rigged Brown & Sharpe screw machines. The special features of these machines were the devices of Mr. Carmody, and their adaptation in a number of instances has become standard to the Brown & Sharpe line of tools, extending their automatic features and increasing their production. That is the prologue.

When the war struck France her greatest need was ammunition. Her factories available for that purpose were too few in number. The machine tool equipment of such factories had been purchased from Belgium and Germany. Even had this source of supply continued to exist, the types of machines previously used, lacking as they did practically all automatic features, were hopelessly inadequate to the production requirements. Without knowing, apparently, just what they were seeking, the French Government turned to America for the organization of its factories on a rapid production basis. Orders for much of the ammunition itself were placed in this country, but the making of fuses has been largely undertaken by the French factories. For this work the Brown & Sharpe automatic machines, Cleveland automatics and Warner & Swasey turret lathes were immediately bought in large numbers.

Manufacturers of the machines were then confronted with the inexperience of the French manufacturer and the French mechanic in the operation of these high-speed large production units, and the problem became at once a question of making effective the capacity of the tool. And here the Brown & Sharpe Mfg. Company turned to the man in Chicago who had so ingeniously adapted its machines to the work described in the article mentioned above.

FRENCH MECHANIC LACKS APPLICATION

Mr. Carmody has just returned from six months in France. His experience was interesting indeed. The French mechanic knows nothing about working under pressure. Apparently he is unfit for it temperamentally, and he lacks the incentive of high wages. Unquestionably the failure of French manufacturers to adopt automatic machinery heretofore may be attributed, in the first place, to the limited cultivation of markets for their manufactures and to the fact that the cost of labor does not justify a high first-cost for labor-saving machinery. The French machinist on day-turn starts to work at seven, quits at twelve, resumes at two and continues until seven, a 10-hr. day. The night shift puts in the remaining twelve hours of the twenty-four on the same schedule. Cigarette smoking during working hours is almost incessant.

The average mechanic lacks application, and while the many romantic stories of the valor of the French and their patriotism are not to be doubted, the threat of the trenches is the most potent influence that the ammunition factory managers seem able to wield in securing from the mechanics that interest in their work which is necessary to operating the high-production machines, that have been installed, at their maximum capacity. Certain it is, in the experience of those who have been in touch with conditions in the shops, that the men brought back from the front to work in the shops (and they are paid at the same rate for this service as at the front) accept the opportunity with greatest eagerness.

WOMEN BETTER OPERATIVES THAN MEN

The women of France are being trained in the operation of these automatic machines and have proved themselves much more trustworthy operatives than the men, both with respect to the inspection of the work and the operation of the machines. The women seem imbued with their own responsibility as a factor in protecting the men at the front through their care in turning out only correct material. They also follow instructions to the letter. The men seem unable to resist an inclination to tinker with the automatics after they are once adjusted to a job, and when pieces begin to run under size or over size they are prone to attempt the remedy themselves rather than to call upon some one competent. One of the great prejudices that had to be overcome was the belief on the part of the French manufacturer that no operative could attend to more than one machine, and in one case it required an actual demonstration by Mr. Carmody, who ran ten machines continuously, unaided, to convince a plant operator that it was possible.

PRIMITIVE PRACTICES

The extent to which hand labor and slow-speed tools have been employed in France, up to the time of the present emergency, has retarded greatly the development of transmission equipment. Industrial France is keenly interested in electricity. Its engineers lean very markedly toward this branch. In consequence nearly all machine tool drive is electrical and individual, plants very largely purchasing their power from central stations. In most of the plants, however, in which Mr. Carmody organized the Brown & Sharpe installations, group drives were set up, but there are no adjustable self-oiling ball-bearing hangers to be had. Most of the hangers consisted of a piece of flat iron shaped to carry a solid box and bolted to the ceiling above. There has been no double-ply belting in use except where in some instances single-ply belts have been crudely laced together. Instances are cited of variations in the width of a belt in service of from 1½ to 3 in. Belt lacing, either with leather thongs or steel wire, using a belt lacing machine, seems not to have been practised at all. The usual method was to lay the two ends of the belt, face to face, and pointing in the same direction, fastening them together with clips about an inch or so from the end. Such a device was, of course, impossible with the

high-speed automatics where the clearances are small, and belt-lacing machines were ordered from the United States.

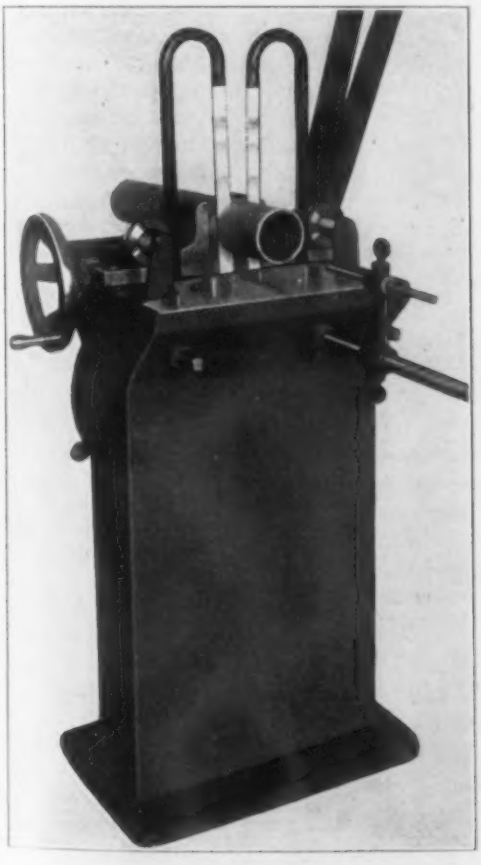
PERMANENCY OF NEW METHODS

The awakening of France to the possibilities of automatic machine production, if it is followed by a permanency of such practice, may be largely credited to the specialist in the Chicago fifth-floor shop. Whether in times of peace that are to follow the present demand for greatest possible production, the cost of labor and the condition of industry will make for a continuation of high-speed methods is open to question, but already the operators of many plants which have been commandeered for government purposes are looking forward to the time when they will use their new equipment in their own businesses. The manufacture of motor vehicles will attract a number of them, and in this line there is an excellent opportunity for the automatic machine. The great variety of screws, studs, bolts, collars and small parts that we are accustomed, in this country, to produce on screw machines, has, in France, been manufactured on ordinary lathes with hand tooling, at which the French mechanic is particularly adept.

Duplex High-Speed Hack Saw Machine

A hack saw machine employing two blades has been developed by the Clarence E. Van Auken Company, 216 North Clinton Street, Chicago, Ill. The blades move up and down in unison, one cutting on the down stroke and the other on the up. In this way the sawing operation is a continuous one, both saws feeding alternately into the stock and releasing on the return stroke. When the machine is idle there is no pressure on the blades.

The machine is equipped with the features found in the single-blade machines, including positive clutch drive, automatic stop, adjustable tension feed, stock gage, etc. The saw frames, which are of heavy seamless tubing, are operated by the customary crank, cross-head and guide mechanism located inside the column, and the lower end of the frames have ball check valves which work up and down in the cooling solution contained in the hollow machine base thus forcing the liquid through the tubing and down on the saws. In this way no lubrication is required for the saws as they are kept flooded with the cooling solution when the machine is running. By reversing the blades it is possible to secure full service from them.



A Recently Developed High-Speed Hack Saw Machine Equipped with Two Blades for Cutting Material from Opposite Sides

The vise screw has both right and left threads which actuate both jaws and keep the work in a central position. For handling short lengths of stock a hold-down attachment is provided and the handle of the operating device screw can be placed on either side as may be desired.

The drive is by direct belt which can be led from either side to the overhead shaft by shifting the idler pulley and it is possible to operate the machine from either side. Two sizes of the machine are built, one for handling stock up to 4 in. square or in diameter, while the other will handle 8-in. stock. The stroke of the smaller machine is 6½ in. and that of the larger is 1 in. greater. The length of the saw blades is 12 and 17 in. respectively and the speed of operation is 135 r.p.m., which gives 270 cutting strokes. Both machines have the bottom of the vise 24 in. above the floor and the size of the floor flange in both is 10 x 16 in. If desired motor-driven machines can be furnished.

Some Pertinent Pig-Iron Figures

From the market report, dated Nov. 27, of the Matthew Addy Company, Cincinnati, the following is taken:

We—the United States—are now making approximately at the rate of 37,500,000 tons of iron a year. But because the first half of the year was dull, the year's output will not much exceed 31,000,000 tons. In 1913 we had up to that time the greatest production—30,966,000 tons. Taking the statistics by periods of ten years we find:

	Tons
1905	22,992,000
1895	9,446,000
1885	4,044,000

In a period of 30 years the increase in iron production has been nearly 800 per cent. To get a comparative view of these figures in 1913—the last normal year abroad—the pig-iron production was:

	Tons
United States	30,966,000
Germany	19,004,000
England	10,482,000
France	5,227,000
Russia	4,475,000
Other countries	7,873,000
And in the whole world	78,027,000

So to-day, on the face of the returns, the United States is making half the iron which the whole world produced two years ago. As a matter of fact, the production of iron has been so greatly reduced in Europe by the war there is no doubt that we are producing a great deal more than half the iron which civilization is making at the present moment.

Iron prices are higher than they have been since 1908, but they are $5 a ton lower than they were in 1907. Speaking in a general way, prices are now about where they were in the early part of 1906. There is nothing abnormally high about them. Looking over the records it seems fair to say that to-day the quotations on iron are about in line with what they were previously during periods of active business.

A motor truck of ¾ to 1 ton capacity to sell for $1,250 has been brought out by the Kissel Motor Car Company, Hartford, Wis. It has a 32-hp. four-cylinder motor and a worm gear drive.

Single Purpose Machines in Shell Making

What Machines and How Many Needed to Produce 100 Shrapnel or 100 High-Explosive Shells Per Hour

BY C. A. TUPPER

In the manufacture of projectiles for field guns conditions under which early contracts were taken necessitated the use of shop equipment already in service, together with such new machines as were then obtainable. At best it was a question of adapting existing plants to a new purpose rather than deliberately trying to plan layouts which would be most suitable. Now, however, that the first rush is over, many shops are being re-equipped along the lines dictated by experience in shell manufacture, and plants built especially to meet the requirements of the new industry have been designed accordingly.

In the movement, the use of "single-purpose" tools has become prominent. The following is intended to show their application to the production of shrapnel cases and then of high-explosive shells from both forgings and the solid bar. Taking 100 shells per hour (single shift) as the output upon which, or multiples thereof, projectile making is now generally figured, we may evolve a combination of machines and operations for, say, 3-in. shrapnel from forgings about as follows:

REFITTED STANDARD TOOLS FOR PRELIMINARY OPERATIONS

With one or two gang millers (of so-called planer or slab type), large boring mills or large-swing lathes arranged with special circular chucks, as described in THE IRON AGE, Sept. 9, the bases of the shell forgings can be economically faced. This, of course, simply means refitting standard tools for special service, making them in effect single-purpose machines. If a central boss only is left, and the forging is otherwise satisfactory, a simple type of facing machine will be best suited to the work; four such being required. Under ordinary circumstances the use of the gang millers mentioned is the most economical.

After gaging to length from the inside of the powder pocket, the shells are then passed to a battery of cut-off machines, each forging being chucked by the closed end and trimmed reamed at the open end. A very simple cut-off machine, with suitable reaming attachment, will suffice. The operation can be rapidly performed and should take not more than 3 min. With a spare machine included, six will ordinarily be required.

STOCKY LATHES FOR ROUGH CUTS OF EXTERIOR

Equipment for the next stage after trimming may consist of ten to twelve plain, stocky lathes. One standard method used is to chuck each shell on an expanding mandrel and take a roughing cut over the entire exterior, at the same time recessing the band seat. Three tool posts can be used simultaneously, with a more rapid feed for the band seat cutter than for the others if the band seat is grooved out at this stage. It is necessary to use machines which will stand up under fast, heavy cuts.

The material is likely to be very hard in spots, due to unequal cooling of the forging.

Table No. 1—Machines for Shrapnel Making—100 Per Hour

Equipment Group	Operation	Maximum Number of Machines	Additional Machines for Solid Bar Work
1	Rough facing base	2 (or 4)	(6 or more saws)
2	Trimming and reaming open end	4	..
3	Rough turning shell body and cutting band seat	12	..
4	Boring (roughing and finishing interior of forging)	20	..
4b	Boring (if from solid bar)	..	12 (heavy)
5	Nosing forging (in press)	2 (with pumps and auxiliary equipment)	..
6	Finish boring, threading and facing nose	6	..
7	Finishing turning body	14	..
8	Finishing band seat	10	..
9	Cutting the band	1	..
10	Banding (in presses)	2 (with pumps, etc., if hydraulic)	..
11	Profiling band	5	..
12	Finishing base	5	..
13	Grinding (if done)	6	..
14	Machining diaphragms	2	..
15	Saw, drill, slotter and miller for test piece	4	..
16	Tool room equipment, duplicated throughout, as explained in text	8 (or more)	..

Table No. 2—Auxiliaries to Machine and Press Work on Shrapnel

Equipment Group	Apparatus	Number of Pieces
17	Sand blast outfit with four pairs of nozzles for cleaning grooves and powder pocket	1
18	Two 5-hole or one 10-hole furnace for nosing, preferably the former	2
19	Furnaces for annealing	2
20	Furnaces for re-annealing or tempering	2
21	Furnaces for banding	2
22	Furnace pyrometers, preferably electric	6
23	Oil baths for tempering	4
24	Scleroscopes	2
25	Trucks and racks	..
26	Painting machines	3
27	Chucks, jigs, fixtures, dies, gauges and markers	..
28	Equipment for making wooden shipping cases	..

THE MACHINES FOR BORING SHELLS

Roughing out and finishing the boring of the shell bodies will require the use of twenty or more spindles, either on single-head or multi-head machines. This is an operation which consists of two cuts each for the powder pocket and lower and upper diaphragm seats, the drill heads being equally divided between the roughing and finishing. There is a special arrangement of tools held in position for each cut. Horizontal drilling machines built on the order of a lathe, as well as lathes themselves, have been found very effective for these operations. A leading equipment house says on this point: "We have always recommended lathes—reasonably heavy—with turrets and different tools for the different diameters. The best production we have seen is at the rate of five per hour per machine."

It should be borne in mind that we are considering the manufacture of shrapnel cases from forgings. If made from the solid bar, as called for in many recent contracts, the boring

equipment required will be the same as that needed for high-explosive shells, described farther along.

For forming the noses of shrapnel, two five-hole furnaces and two special presses or swaging machines should suffice. Lead baths, with pins over which to invert the shells, may be substituted for the side-hole furnaces.

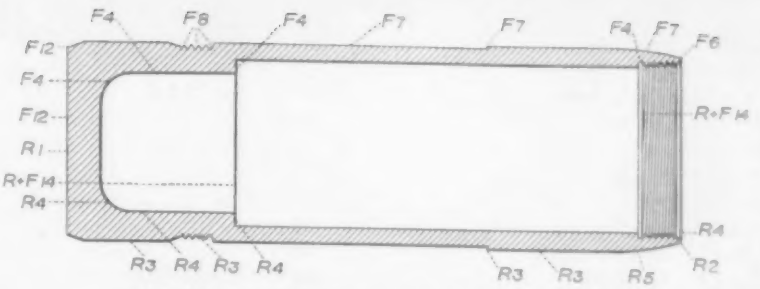


DIAGRAM OF OPERATIONS ON SHRAPNEL SHELL

The numbers refer to equipment groups in Table No. 1. For banding and profiling see diagram for high-explosive shells. R = roughing; F = finishing; R + F = roughing and finishing

The boring and threading of the nose, as well as facing off its end, can be carried out on not to exceed six special machines for that purpose. Each shell is held by its base in a jaw chuck, and the two parts of the operation take place with a single setting.

EQUIPMENT FOR SHELL BODY EXTERIOR FINISH

Finishing the exterior of the shell body, including the nose, which must naturally be left until after the press-work of "nosing-in," when shrapnel cases are made from forgings, can be accomplished with a battery of machines similar to those used for rough turning, twelve to fourteen being necessary if one or two spares are allowed for. Each shell is centered by a threaded driving plug in the open end and held by a jaw chuck at the base. "Manufacturing automatic" machines, if obtainable for this purpose, will do the work in the least time, but only a very ordinary lathe is essential.

The finishing of the band seat, undercutting and waving, will take lathes of the same general class as those for the roughing and finishing cuts on the body. A turret tool post enables all the ordinary operations to be performed at one setting, and for waving there is a special arrangement which has already been described fully in THE IRON AGE, June 24 and Sept. 9. This is essentially single-purpose apparatus and can be nothing else.

The statement has been made to the writer from an ordinarily reliable source that these operations for 100 shells per hour could be accomplished with five lathes. This means an output of twenty for each machine per hour, or one every 3 min., including handling and without allowance for errors and machine troubles. As, however, it is doubtful whether any shop can maintain continuous production on a 3-min. basis, it would be safer to allow 5 min. This, with a spare lathe or two, would make nine or ten machines to be provided for the operation.

THE NEEDS FOR THE RIFLING BANDS

For cutting copper bands from tubing to be forced on the shell special machines have been developed, the essential feature of a leading type of which is the use of a hollow spindle with spring collet chuck and a suitable automatic feeding device. One of these machines is sufficient for the rate of production which we are considering.

The banding operation itself requires furnaces and two special presses. In one of the latter which has been very successfully used, the dies first strike a sharp blow and then exert sufficient pressure to force the copper into the groove and waves. A combination press, which can be used for both this operation and the nosing process above mentioned, was described in THE IRON AGE, Nov. 4.

For turning the band, or profiling, as it is generally known, a battery of five light lathes is necessary.

Finishing off the base, including the radius chamfer, requires four to five light lathes or special facing machines.

Grinding, if required, calls for four plain and two formed wheels. This must be done with self-contained machines which will combine speed with accuracy. It was an early refinement of shell making which, so far as the writer can learn, has since been abandoned.

For painting or spraying the shells, including the port of the separate nose-piece or fuse-base, when the latter is screwed on, one of the several machines already described in THE IRON AGE will suffice. The spraying type shown Aug. 12, page 355, seems to be particularly effective.

TOOL ROOM AND OTHER EQUIPMENT

The above does not take into account the production of the upper and lower diaphragms, central tube, powder cup, fuse body, fuse or loading charges, but merely the shell body, which ordinarily forms an article of manufacture entirely distinct from that of the smaller parts. The latter also include the temporary stopper plug used in shipping the shell. If the diaphragms are made in the same shop, as is now getting to be more the case than formerly, they can be readily turned on two automatic machines, one of which will ordinarily be held in reserve while the other is operating.

The equipment required for machine work and press work will therefore run as shown in Tables No. 1 and No. 2. The former lists the machines used and the latter the apparatus auxiliary to them.

All of the apparatus described should be supplemented by fair tool-room equipment, including milling machine, shaper, tool grinder, etc., and this should be separate and away from the productive operations. Two complete sets of tools throughout are to be recommended; so that lathe tools, drill tools, reamers, etc., will always be in good condition and so that no work will be held up on account of broken tools. This provides for one complete set of tools in service and one set in the tool room at all times.

Turning from Shrapnel to Explosive Shells

If a manufacturer who has been turning out 3-in. shrapnel from forgings decides to enter upon the production of, say, 3.29 or 3.31-in. high-explosive shells from solid bar, a considerable part of the equipment outlined above will be suitable for the purpose also.

Unless, however, he has meanwhile made some shrapnel from the solid bar and has changed his equipment accordingly, he will need to make provision at this point to start where the forge shop operator does, viz., with cutting bar stock to length. As the length of each blank to be machined is approximately that of the finished body, there is not the same object in the multiple cutting described

in THE IRON AGE, Sept. 2, page 512, as in the case of shrapnel, where a thick, short forging blank is to be pierced and drawn to length.

Hence any of the regular types of saws for cutting bar stock makes a good single-purpose tool. It is true, however, that manufacturers are very apt to overrate their ability to cut this material to length; 3 min. per cut, including handling, is the best that can be expected on the basis of constant operation, and this would require five or six machines. Such machines to give this output are of the type in which more than one bar can be placed on the table at one time, or else of the friction type. If the stock can be secured from the mill sheared to length, so much the better, but the additional expense and delay of handling may offset any saving. For facing off the base and eliminating any inequality or burr left by sawing, the equipment described for the similar operation on shrapnel will suffice.

HEAVY EQUIPMENT FOR BORING HIGH-EXPLOSIVE SHELLS

Boring high-explosive shells or shrapnel from solid bar requires entirely different tools for the first operation than in the manufacture of shells from forgings. Heavier equipment must be used.

A conservative estimate for rough boring, based on average practice, will give ten shells per machine per hour. This is with the use of a heavy drill of the standard upright type; and the best results known to the writer have been secured by means of inverted boring (see THE IRON AGE, page 807, Oct. 7), using a special chuck with an eccentric clamp. On the basis mentioned, ten to twelve machines will be required.

Finish boring, turning the step on the nose, and the nosing-down and tapping can be accomplished at this stage with a special turret machine at the rate of four to five per hour for each machine. It appears to be cheaper to do the work in this way than to finish boring on vertical drills or to utilize any machines that may have been carried over from shrapnel manufacture. With the production given, twenty-two to twenty-four machines should suffice, although twenty-six would not be excessive, allowing for spares.

MACHINES NEEDED FOR TURNING

Rough turning the shell body, at a rate of five to six shells per hour for each machine, will call for eighteen to twenty plain lathes and finish turning for ten to twelve additional ones.

For certain types of lathes it is claimed that the entire machining of the body, so far as turning is concerned, can be accomplished at one setting by "multiple tool work," that is, by a special arrangement of tools held in rigid position for each operation necessary. How the results compare in cost with the use of single-purpose tools, above outlined, the writer is not in a position to say.

Next follows the use of lathes for finish grooving, undercutting and waving the band seat. Nine or ten machines are required. The same equipment can be used as for shrapnel. Details of the operations necessary for roughing and finishing the shell body, including the band seat, were given fully in THE IRON AGE, Oct. 7, page 807.

Table No. 3—Machines for the Manufacture of High-Explosive Shells—100 per Hour

Equipment Group	Operation	Number of Machines	Machines Carried Over from Shrapnel Making
1	Cutting bar stock to length of shell blank, single saws	6	6 (if shrapnel bored from bar)
2	Facing off base	2 (or four)	2 (or four)
3	Rough boring	12	12 (if shrapnel bored from bar)
4	Finish boring	24	..
5	Rough turning shell body	20	12
6	Finish turning shell body	12	10–14
7	Machining band seat	10	10
8	Threading throat and recessing and threading base	10	5 (see text)
9	Cutting the band	1	1
10	Banding (presses)	2 (with pumps, etc., if hydraulic)	2
11	Profiling band	5	5
12	Finishing base	4	3
13	Grinding (if done)	6	6
14	Test piece cutting	4	4
15	Manufacture of plug from forging	2	..
15b	Tap drilling for nose set screw	1	..
16	Toolroom equipment, duplicated throughout, as explained in text on shrapnel	8	8

Table No. 4—Auxiliaries to Machine and Press Work on High-Explosive Shells

Equipment Group	Apparatus	Number	Carried Over from Shrapnel Making
17	Furnaces for annealing	2	2
18	Furnaces for tempering	2	2
19	Furnaces for banding	2	2
20	Furnace pyrometers	6	6
21	Oil baths for tempering	4	4
22	Scleroscopes	2	2
23	Sectional oven for 100 shells	1	..
24	Painting machines	3	3
25	Trucks, racks, etc	..	..
26	Chucks, jigs, fixtures, dies, gages and markers	..	..
27	Equipment for making wooden shipping cases	..	..

REQUIREMENTS FOR THREADING OPERATION

After heat treatment, which should precede any threading operations, the throat of the shell body, or inside of the nose, is threaded. Also, the base is recessed and threaded. The latter operations pertain distinctly to high-explosive shells. They are not needed for shrapnel even when machined from the solid bar. Apparatus which can be used for the threading at either end as well as for the recessing of the base, and is the most efficient of any known to the writer, consists of a thread milling machine designed especially to meet the conditions of shell manufacture.

For either set of operations the shell is secured in a hollow, revolving spindle and self-centered. An automatic device stops the machine when the thread is completed. Eight or nine of these machines, or ten at most, will serve for successively performing both the nose and base operations above described. Machines previously used on the nose of shrapnel can be applied to threading the nose of a high-explosive shell, but additional machines will be needed for threading the base. If entirely new units are provided, therefore, it will be economy to get machines which are interchangeable for the two operations.

For cutting the band, pressing it on and profiling it, the four sets of apparatus (including furnaces, etc.), enumerated in the foregoing for shrapnel will serve identical purposes in the case of high-explosive shells, and no more are required. If a grinding finish is given, the same grinders will likewise suffice.

Trimming, facing and chamfering the base can be done with the

same machine used for trimming and reaming the open end of shrapnel, although with different attachments. At least one more unit will be needed, however. The plug, which comes to the shell maker as a rough forging, can be finished off and threaded in a single automatic machine, with another held in reserve. If diaphragms for shrapnel cases (which are not needed for high-explosive shells) have been made in the same shop, the equipment used for them can probably be adapted to turn out base plates or "plugs."

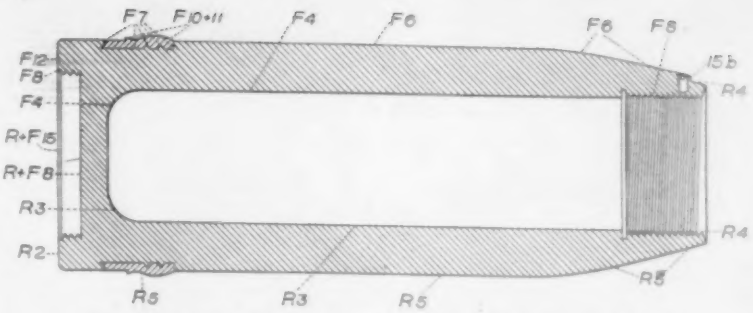


DIAGRAM OF OPERATIONS ON HIGH-EXPLOSIVE SHELL

The numbers refer to equipment groups in Table No. 3. R = roughing; F = finishing; R + F = roughing and finishing

Additional equipment which can be carried over from shrapnel to high-explosive shell making comprises the annealing and tempering furnaces, the number of which naturally depends on their capacity per heat, as well as the pyrometers, oil baths, trucks, racks and other auxiliaries. Neither the sand-blast outfit nor the nosing furnaces will be needed, however, and entirely new sets of jigs, fixtures and gages will be required. Markers can be adjusted to the new purpose, and "marking machines" are now offered which serve practically any requirement. New equipment which may be added includes sectional ovens for baking the shells when coated with an anti-corrosion shellac or varnish, if called for by the specification.

NEEDS FOR MAKING FUSE BASES

If fuse bases to mate with the shell bodies are made in the same plant, no great quantity of additional equipment will be necessary. Three drill heads and four automatic four-spindle chucking machines ought to suffice. In the latter the single-purpose idea gives way to multiple operation as by all means the most economical. The lower part of the fuse base can be faced, turned, bored, finish drilled, recessed and threaded both inside and outside simultaneously, at a rate of fifty per hour claimed to be easily maintained; while the upper end is faced, turned, drilled, recessed and tapped in one succeeding operation, at very nearly the same rate of production. The material used is a formed forging, which comes to the chucking machines after being first drilled with the heads above mentioned. In operating the latter only the two settings are required, one for each two-machine unit. Besides these tools it is, of course, necessary to provide suitable furnace capacity for annealing and tempering. Whether this is additional to that required for the shell bodies will naturally depend upon the capacity available and the service secured from it.

In planning equipment for machining 3-in. shells, it may be desirable to install apparatus which, so far as its nature permits, will handle sizes from 2.95-in. (75 mm.) up to 6 in., including the 3-in., 3.29-in., 3.31-in., 3.8-in., 4-in., 4.5-in., 4.7-in. and 5-in. sizes. The lathes, boring heads, etc., will not need to be a great deal heavier, and in respect to furnaces or other auxiliary equipment it is simply necessary to provide extra units or make slight alterations, as in the case of the port-hole plates of nosing furnaces. Some apparatus, like special cut-off and trimming or facing machines, is built only for a certain size or a limited range of work and will, of course, have to be replaced altogether for anything outside of this range.

ADVANTAGES OF THE SINGLE-PURPOSE TOOLS

Advantages in the use of single-purpose tools, or standard machines which are simple in design and can be used constantly for the same operation, are similar to those which have been found in the manufacture of automobile parts. Among these is the fact that they can be run with very ordinary or semi-skilled labor and maintain high-productive capacity at low labor cost. They also facilitate piece work. Where this is the rule, they are more desirable than turret machines, and it must be remembered, in considering the foregoing, that this question of labor has a most important bearing upon the entire problem of equipment. When piece work is compared with day work there will be a very considerable difference in requirements.

The basis of computation, viz.: 100 shells per hour for a single day shift of 8 to 9 hr., should also be borne in mind. If eighty shells per hour is the basis, there will be a nearly corresponding decrease in the number of machines required for each operation; while two standard shifts or three shifts of 7½ hr. each mean just so much further possibility of restricting the totals. This reduction, however, cannot be in direct arithmetical ratio, for the reason that the spare equipment which must be provided for remains very nearly constant. There should always be a surplus of at least one machine for each operation, to allow for breakdowns and repairs as well as other contingencies which may or may not be foreseen.

Improved Krause Jolt Ramming Machine

The Vulcan Engineering Sales Company, 2059 Elston Avenue, Chicago, Ill., has placed on the market an improved Krause electro-pneumatic jolt ramming machine. This machine in its original form was illustrated in THE IRON AGE, June 4, 1914, and the principal improvement is the use of the double silent chain drive running in oil in an inclosed gear case instead of the exposed gear and crank in the earlier form. The machine is driven by a motor and air at atmospheric pressure enters the compression chamber of the machine and is compressed to the operating pressure by the forward movement of the piston. This air passes through a connection to the cylinder, raising the plunger and table and when the exhaust port opens the air in the plunger rushes out, permitting the plunger and table to drop. The jolting operation is controlled by a valve located between the compression chamber and the cylinder and when this is open air at atmospheric pressure circulates through the machine with the action of the piston and is not compressed.

The American Shop Equipment Company, McCormick Building, Chicago, Ill., specialist in shop devices, has issued a series of export data bulletins. These are printed in English, French and Spanish and give shipping data for the company's line of oil furnaces for welding, forging, melting and annealing. Illustrations and brief descriptions of the various types of furnaces are presented.

The Unreliability of Brass and Bronze

The Failures of Brass and Bronze Castings and Forgings on the Catskill Aqueduct—Lack of Knowledge of Conditions of Use of These Materials

A startling indictment against the use of brass and bronze in civil engineering works is brought out in a paper read by Alfred D. Flinn, deputy chief engineer of the Board of Water Supply, New York City, before American Institute of Metals at its meeting at Atlantic City, Sept. 28. The paper describes defects which developed in brass and bronze fittings furnished for the new Catskill aqueduct for New York City and which were made under rigid specifications by manufacturers of wide experience and proved reliability. The defects appear to be due to disintegration of the metal without apparent cause, developing cracks and fractures even before the material was put in service. If the facts are as they appear on the surface, according to Mr. Flinn, they indicate the total unreliability of the alloys of copper for use in situations similar to those on the Catskill aqueduct.

The alloys referred to in the paper comprise various copper alloys containing not over 70 per cent of copper, including many metals which are commercially denominated bronze of one kind and another. Due to the inaccessibility for repair of many portions of the aqueduct it was deemed inadvisable to utilize iron and steel on account of the tendency to corrosion and the importance of permanently guarding against this. Included in the list of parts for which iron and steel were deemed unsuitable are sluice gate anchors and other large bolts, large and small valves of ordinary and special design inaccessible for inspection and repairs or not replacable without putting the aqueduct out of service, special pipe castings similarly situated to the valves, and permanent ladders in deep gate wells or manholes which would unavoidably be damp. The total weight of the various parts aggregated about 3,000,000 lb., of which castings comprised more than 2,000,000 lb. These ranged in weight from a few ounces to upwards of 22,000 lb. In the forgings there were bolts ranging from ordinary sizes to ones weighing 3200 lb. each, the latter being sluice gate stems 6 in. in diameter and 31 ft. long.

SPECIFICATIONS

In selecting the metal for these various parts government bronze, manganese bronze, naval brass, phosphor bronze, Tobin bronze, vanadium bronze, Monel metal and other alloys were investigated. Common brass was not seriously considered on account of its known corrodibility under the circumstances which existed. As a result of the investigation, manganese bronze was selected. All the brass used in the aqueduct was made under specifications and was subject to inspection. Wherever possible hydrostatic and other tests which seemed feasible were made in addition to the customary tensile and other physical tests. The specifications, as a rule, stipulated the desired physical qualities without giving at the same time the metallurgical composition. The methods of manufacture were rarely specified as the manufacturer was believed to be more competent to determine these from his experience than was the engineer. Following are typical extracts from the specifications:

Bronze Castings.—All bronze castings shall be made of new metal, shall be free from objectionable imperfections and shall conform accurately to patterns. When the castings are being machined, if the metal shows signs of imperfect mixing, they shall be rejected. Unless otherwise called for in the specifications, or upon the drawings, bronze where indicated upon the drawings shall mean manganese bronze.

Manganese Bronze.—All manganese bronze shall be equal to Spare's, Parsons' or Hyde's manganese bronze, and shall have a tensile strength of not less than 65,000 lb. per square inch, an elastic limit of not less than 45 per cent of the ultimate tensile strength and an elongation of not less than 25 per cent (in 2 in.).

Brass Rivet Rod.—Tensile strength of brass rivet rod shall be not less than 55,000 lb. per square inch. The elastic limit shall be not less than 30,000 lb. per square inch, and the elongation not less than 20 per cent.

Stems.—The main gate stem shall be of manganese bronze, or other bronze of approved composition, of such dimensions that when placed in tension under a load in pounds equal to the area of the valve opening in square inches multiplied by 125, the minimum cross-section of the stem shall have a resultant unit stress not exceeding two-thirds the elastic limit of the material used. These stems shall be turned straight and true and shall have all threads lathe-cut.

Rolled Bronze.—Whenever the term "Bronze" is used in these specifications in a general way, or on the drawings, without qualification, it shall mean manganese or vanadium bronze, or Monel metal. Whenever the characteristics of any material are not particularly specified, such material shall be used as is customary in first-class work of the nature for which the material is employed.

The minimum physical properties of bronze shall, except as otherwise specified, be as follows:

Castings

Ultimate tensile strength	65,000 lb. per sq. in.
Yield point	32,000 lb. per sq. in.
Elongation	25 per cent

Rolled Material, Thickness 1 In. and Below

Ultimate strength	72,000 lb. per sq. in.
Yield point	36,000 lb. per sq. in.
Elongation	28 per cent

Rolled Material, Thickness Above 1 In.

Ultimate strength	70,000 lb. per sq. in.
Yield point	35,000 lb. per sq. in.
Elongation	28 per cent

After being forged into a bar, rolled or forged bronze shall stand, first, hammering hot to a fine point; second, bending cold through an angle of 120 deg. to a radius equal to the thickness of the bar.

TYPICAL TESTS

Typical tests of the various materials used on the aqueduct are exhibited in the following tables:

Yield, Lb. per Sq. In.	Ultimate Strength, Lb. per Sq. In.	Elongation, Per Cent	Reduction, Per Cent	Fracture
		FORGINGS		
36,500	73,150	41.5	46.8	Irregular
37,500	75,750	35.5	43.9	Irregular
38,250	76,900	35.5	46.8	Irregular
52,500	77,100	31.0	...	Irregular silky
49,300	76,150	33.5	...	Silky cup
50,000	75,350	31.0	...	Irregular silky
43,500	70,000	34.0	47.0	Irregular
36,000	67,500	40.5	43.5	Irregular
		CASTINGS		
39,650	66,000	40.0	...	Irregular gran.
43,100	68,850	25.0	...	Irregular gran.
39,950	68,050	29.0	...	Irregular gran.
33,000	66,250	25.0	25.4	Irregular
32,750	67,500	30.0	27.7	Irregular
32,250	67,200	36.0	34.1	Irregular
39,500	69,100	39.0	...	Irregular silky
47,500	71,000	40.5	...	Irregular gran.
50,000	70,000	34.0	...	Ang. silky
33,250	73,000	30.0	28.5	Irregular
33,000	73,500	35.0	34.0	Irregular
34,500	73,250	40.0	36.5	Irregular
43,250	69,950	40.5	...	Ang. silky
44,000	70,050	34.0	...	Irregular deep cup fine gr.
42,500	69,500	37.5	...	Ragged cup, silky
46,000	69,850	33.0	...	Ang. cup silky
44,000	69,600	40.5	...	Ang. fine gran.
41,500	72,350	36.5	...	Irregular ½ cup silky
40,000	68,000	38.0	...	Forked silky
42,000	67,000	37.0	...	Ang. silky
43,750	69,050	37.0	...	Deep fork silky

In a few instances brass and bronze pipes were required in portions of the aqueduct and for these the specifications include the following:

The pipe shall be seamless drawn, semi-annealed, iron-pipe-size tubing of the sizes shown on the contract drawings or ordered. It shall be made of the bronze specified in the general sections, or of an approved commercial bronze. All pipe furnished under this item shall be free from season cracks, surface cracks, or other defects.

When the pipe is finished, ready for shipment, the engineer will subject about 1 per cent of the lot, taken at random, to the following tests:

1. Each test pipe shall stand threading perfectly, with a die with the usual thread for the size of the pipe.

2. After annealing, the end of each test pipe shall stand being flattened by hammering until the sides are brought parallel, with a curve on the inside at the ends not greater than twice the thickness of the metal, without showing cracks or flaws.

3. After annealing, each test-piece shall have a piece 3 in. long cut from it, which, when split, shall stand opening out flat without showing cracks or flaws.

DEFECTS WHICH DEVELOPED

The foregoing specifications and tests indicate that every care was used to secure material which would prove absolutely reliable both as regards strength and durability. Notwithstanding the care which was taken in the preparation of the specifications and the supposed care in manufacture and in the tests to prove adherence to the specifications, the behavior of the brass and bronze parts has been far from satisfactory. In the fall of 1913 numerous bolts and rods were found to be cracked and additional similar failures had been discovered almost continually since that time.

Up to the spring of 1915 the more important and numerous failures comprised defects in large plates, bolts, rods, side bars and rungs of ladders and in similar wrought objects. Many of these objects had not yet been installed but had been in storage, some even being still in their packing cases. The bolts and rods usually had circumferential cracks partially or all the way around. Flats had cracks starting in from an edge with a characteristic curvature. Some of these were fine and superficial; others were wide and deep. In a number of cases bolts ranging from ½ to 2¼ in. in diameter were found severed, or broke upon being subjected to a light blow or pull. In certain instances the cracking was progressive and in others two or three years have passed before defects developed.

The larger forgings, including the stems for large sluice gates and valves, have shown no signs of failure and it is only since the spring of 1915 that manganese bronze castings from at least three different foundries have been found cracked. All these castings before acceptance had been subjected to hydrostatic pressure tests of from 200 to 300 lb. per square inch for a half-hour or more and had appeared satisfactory. Later, after having been placed in service, these castings leaked under pressures of but a few pounds. In some of these castings the cracks have grown with the lapse of time and additional cracks have been discovered. In most cases these cracks appear to be close to, or in a repair made by the method of "burning-in" or welding. This practice, however, is of long standing and of general use in reputable brass foundries. While the investigation has not yet proceeded far enough to justify any further statement, it is evident that the application and details of such method of repair and other details of brass foundry practice need to be carefully studied by foundry metallurgists.

Trouble experienced with wrought brass or bronze may be classed as follows: 1. Breaks from stress. (a) Initial stress due to methods of manufacture; (b) applied stress, due to use. 2. Damage by wrong heat treatment as in forging, bending, flanging, upsetting and annealing. Damage of the second class results entirely from lack of skill, knowledge or care on the part of the manufacturer or fabricator.

Although much study has been given to the remedy for this condition of affairs there has seemed to be nothing else to do than to use steel or iron with their known disadvantages, burying them in concrete or mortar wherever feasible, galvanizing them or using other protective coatings in still other places.

It is evident that designers have been misled by the representation that certain bronzes or brasses possessed great strength and other excellent qualities. Both maker and user evidently have misinterpreted the results of the usual standard laboratory tests, from lack of knowledge of the characteristics of copper alloys not revealed by such tests. The experiences on the Catskill aqueduct indicate that the bronze and brass as supplied under contract, with careful inspection following established methods, would not perform the expected duty. They have also made it evident that there is necessary not only an explanation of the failures of brass but a fundamental knowledge of the physical characteristics and capabilities of this group of alloys which will be a safe and dependable guide in their manufacture, inspection and use.

The author of the paper holds it inconceivable that the troubles experienced should have developed suddenly or at least that they should have become widely known only recently, or that knowledge of such failures if they had been frequent in the past, should have been withheld by the manufacturer. Based upon the experience with brasses on the aqueduct the author of the paper propounds the following questions which must be answered before brass and bronze can be regarded as a satisfactory and reliable material for large civil engineering works.

Were any changes made in the methods of manufacture or in the ingredients of these alloys about the time that the production of brass for the Catskill aqueduct began?

What were these changes and why were they made?

What changes, if any, have been made by the manufacturers in their processes, materials and methods since the troubles with various brasses and bronzes on the Catskill aqueduct were discovered and made known?

If no changes have been made, is it to be inferred that the manufacturers still believe that the methods and materials used in producing brass for the Catskill aqueduct were satisfactory? If so, how are the failures accounted for?

Can a brass or bronze of high tensile strength be reliably produced which can be used safely for important, permanent structures in such parts as bolts and other rolled, drawn, extruded or forged shapes?

What should be the specifications for such brasses or bronzes?

What inspection methods and tests should be used?

By what tests can the tendency to subsequent failure be detected at any time after manufacture?

What working stresses may be used safely for these various alloys?

Will these brasses, or bronzes, deteriorate by reason of constantly applied or frequently repeated stress—i. e., will they fail from fatigue?

Can large, hollow, manganese bronze castings be made of such forms as water and steam valves?

If manganese bronze is not suitable for such castings, what composition can be used?

Can any repairs of brass, to be subjected to hydrostatic pressure, be safely made by any processes of "burning-in," or welding, now commonly used? If so, what relation has the shape and size of the casting to the methods and means to be employed?

What tests can be applied to prove that such a repair has been successfully made and that later a crack will not develop because of it?

A patent (U. S. 1,130,678—March 2, 1915) of Walter Rübel, of West End, near Berlin, Germany, relates to a process for manufacturing an alloy of iron technically free from silicon, phosphorus, and manganese and of a corresponding admixture of copper. The alloy is for dynamo-electric purposes, or dynamo sheets, which must be very pure and at the same time completely deoxidized. The new process consists in deoxidizing purified and superoxidized iron by means of a small quantity of alkali earth metal added in the form of an alloy with copper. For example, calcium, equal to 4 per cent of the copper to be used, may be added in the form of an alloy with copper. The result is claimed to be an iron almost free from silicon, manganese, phosphorus and carbon.

These photomicrographs, Figs. 1 and 2, both of the same magnification, show the extremes in initial structure which may be found in the same heat of unannealed acid open-hearth steel castings. Fig. 2 shows an extreme case of ingotism, entirely absent in Fig. 1. Variations between these types are found in all heats and in portions of the same casting, depending on the thickness of the metal and other conditions. As this initial structure varies, so do the static properties.

The Initial Structure of Steel Castings

How It Varies Because of Cooling Conditions and How It Persists After Heat Treatment in Affecting Static Properties

BY EDWIN F. CONE

The microscope has radically changed our views regarding the properties of steel castings. It has also opened up a new vista as to their real structure. The chemical composition does not necessarily predetermine their physical properties, other conditions of heat treatment, etc., being the same. To state with certainty that a given carbon content will result in a definite strength was once a common occurrence. Frequent exceptions were brushed aside as abnormal or of no immediate interest.

The fact, often repeated, that various portions of the same heat of steel gave decidedly different static results led the writer to attempt to throw light on the real cause. The recognized foundry practice of annealing steel castings by allowing them to cool slowly from a thorough heat permeation just above the recalescence point was not found to explain the phenomena. Tests of the same heat, annealed under the same commercial conditions, often varied widely in their properties.

It is a recognized fact that not only the temperature of pouring but also the rate and conditions of cooling the steel result in a wide variation in the crystalline structure of steel castings. In the ordinary jobbing steel foundry, producing castings by the acid open-hearth steel process, it is possible to select from the same heat of steel specimens of metal varying in structure under the microscope from those shown in the two representative extremes of Figs. 1 and 2. The former is a "lace-like" net structure, characteristic of certain conditions of cooling and shape of casting and admittedly beautiful; the other is the exaggerated structure always found in large castings and known as "ingotism." Within those limits almost any combination or variation can be readily found.

In order to determine whether this varied crystalline arrangement, resulting from the various conditions of temperature and rate of cooling to which the steel in test bars is subjected, has any effect on the final physical properties, the following experiments were made by the writer:

In the same heat of steel thirty test bars, 8 x 3 x 1 in., were cast in such a manner that they were detached from any large or medium body of metal so as to insure relatively rapid cooling in the sand. The microstructure resulting from these conditions is represented in photomicrograph Fig. 3. Its resemblance to Fig. 1 is manifest.

In this same heat extra bars were placed on some large locomotive frames, and some of them detached in the green for examination. The photomicrographs, Figs. 4 and 5, represent the microstructure of this same metal under conditions where the bar is attached to large castings when cooling in the sand.

The physical tests resulting from these three conditions of green steel are shown in Table 1.

In order to get at the effect on the static properties of these various structures, both in the "slow" and "quick" method of heat treatment or cooling of castings, these two classes of microstructure were annealed by both methods.

Fig. 3—Structure of the 30 Experimental Test Bars Used for This Investigation. Its similarity to Fig. 1 is evident. The physical properties and composition of this steel (0.27 C) are given in Table 1

Table 1.—Physical Properties of Three Different Structures of Green Cast Steel

	Tensile Strength, Lb. per Sq. In.	Elastic Limit, Lb. per Sq. In.	Elongation in 2 In., per Cent	Reduction of Area, per Cent	Fracture
Fig. 3	72,000	42,500	26.0	30.9	Irregular
Fig. 4	73, 00	43,000	24.0	32.5	Irregular
Fig. 5	73,000	42,500	28.5	34.1	Irregular

The chemical analysis of each piece was as follows:

	Carbon, per Cent	Manganese, per Cent	Silicon, per Cent	Sulphur, per Cent	Phosphorus, per Cent
Fig. 3	0.27	0.67	0.289	0.042	0.031
Fig. 4	0.27	0.72	0.327	0.042	0.033
Fig. 5	0.30	0.69	0.301	0.040	0.036

BARS OF LACE-LIKE STRUCTURE—SLOW COOLING

Physical Properties.—Twenty-six of the small bars, having a microstructure represented by Figs. 1 or 3, were placed in twenty-six different parts of a large pit annealer where the temperatures ranged up to 100 deg. Fahr. above the recalescence point. After the usual annealing they were removed when cold and each one was examined physically and microscopically. The physical results from these twenty-six bars are given in Table 2.

The general excellence and uniformity of these tests is rather significant,

no matter in what part of the annealer they were placed nor whether the temperature was excessive or the location near large or small castings.

Microscopical Results.—The microstructure of the above 26 bars was examined under the microscope and there was also found here a marked general uniformity of microstructure. Photomicrograph Fig. 6 is typical of each of the bars, revealing not only a uniform structure but one that is not usually found on the general run of castings, even from the same heat, as will be demonstrated later.

Figs. 4 and 5 Represent the Same Metal as Fig. 3 Under Different Cooling Conditions—Attached to Large Castings. The structure is midway between that of Figs. 1 and 2. The physical properties and composition are given in Table 1

BARS OF LACE-LIKE STRUCTURE—QUICK COOLING

Physical Properties.—Some of these small bars were annealed by the quick-cooling process, i.e. brought up to above the recalescence point, and after proper permeation with heat, were brought out into the air. The physical results from this method of treatment were those given in Table 3.

Table 2.—Physical Properties of 26 Bars of Lace-Like Structure, Annealed in 26 Different Places in a Large Annealer

	Tensile Strength, Lb. per Sq. In.	Elastic Limit, Lb. per Sq. In.	Elongation in 2 In., per Cent	Reduction of Area, per Cent	Fracture	Elastic Ratio, per Cent
1	75,000	40,500	26.5	40.9	½ cup	
2	76,000	45,000	20.0	41.9	½ cup (end break)	
3	75,000	40,000	26.5	40.3	½ cup	
4	75,000	41,500	26.0	43.4	½ cup	
5	76,000	41,000	26.5	40.3	Irreg.	
6	76,000	40,000	26.5	43.4	½ cup	
7	74,500	39,000	27.0	43.4	Irreg.	
8	74,000	40,000	27.0	43.4	Irreg.	
9	75,000	41,000	27.5	43.4	Irreg.	
10	76,000	41,500	26.0	41.9	Cup	
11	76,000	42,500	26.5	43.4	½ cup	
12	75,500	40,000	26.5	43.4	Irreg.	
13	75,500	40,500	26.0	41.9	½ cup	
14	74,000	41,000	27.0	43.4	Irreg.	
15	75,500	40,500	25.0	41.9	Irreg.	
16	76,000	43,000	26.0	43.4	½ cup	
17	76,500	40,500	26.5	43.4	½ cup	
18	75,000	40,500	26.0	41.9	½ cup	
19	75,500	42,000	25.5	40.3	Irreg.	
20	74,500	40,000	27.0	41.9	Irreg.	
21	75,000	41,500	26.0	43.4	½ cup	
22	74,500	38,000	27.0	43.4	½ cup	
23	75,500	39,000	28.0	41.9	½ cup	
24	75,000	38,500	28.0	38.8	½ cup	
25	76,000	40,000	25.5	43.4	½ cup	
26	75,000	39,000	25.0	41.9	½ cup	
Average	75,300	40,610	26.15	42.30	½ cup	53.93

Microscopical Results.—Photomicrograph, Fig. 7, reveals the condition of the metal resulting from this procedure.

BARS OF LARGE STRUCTURE—SLOW COOLING

In order to contrast the effect on the physical results of the microstructure resulting from bars attached to castings, steel of large microstructure was subjected to the same process as the other.

Physical Properties.—The physical results, as obtained by the regular process of annealing from the large microstructure, are shown in Table 4.

Microscopical Results.—The microstructure resulting from this initial structure after slow cooling is shown in photomicrographs, Figs. 8 and 9. Though fair, it is not as good as that from the other class of steel under the same conditions and time of treatment as represented by Fig. 6. It is not as uniform and regular.

Fig. 6 Shows the Structure of the 26 Experimental Bars After Annealing with Slow Cooling. Its uniformity is characteristic. This was taken from test No. 13 in Table 2. Fig. 7 shows the structure of this same steel cooled quickly. This was taken from the first physical test of Table 3

BARS OF LARGE STRUCTURE—QUICK COOLING

Physical Properties.—Upon putting some of the bars of large structure, detached from the frames, in the annealer and annealing them by the quick method, results were obtained as shown in Table 5.

These exhibit the same increased tensile strength and elastic ratio over the slow annealing, but are rather poor in ductility, as compared with those from the bars of fine structure.

Table 3.—Bars of Lace-Like Structure, Quickly Cooled

Tensile Strength, Lb. per Sq. In.	Elastic Limit, Lb. per Sq. In.	Elongation in 2 In., per Cent	Reduction of Area, per Cent	Fracture	Elastic Ratio, per Cen
79,000	45,500	28.5	43.4	½ cup	57.6
78,000	47,500	27.5	34.1	Irreg. flaw	60.9

Table 4.—Physical Properties of Bars of Large Structure, Cooled Slowly

Tensile Strength, Lb. per Sq. In.	Elastic Limit, Lb. per Sq. In.	Elongation in 2 In., per Cent	Reduction of Area, per Cent	Fracture	Elastic Ratio, per Cent
74,500	41,000	27.0	38.8	Angular	55.0
76,500	41,000	25.5	40.3	½ cup	53.5

Table 5.—Physical Properties of Bars of Large Structure, Cooled Quickly

Tensile Strength, Lb. per Sq. In.	Elastic Limit, Lb. per Sq. In.	Elongation in 2 In., per Cent	Reduction of Area, per Cent	Fracture	Elastic Ratio, per Cent
81,500	48,000	23.5	34.1	Irreg.	58.89
80,000	47,000	23.5	30.9	Irreg.	58.75
82,000	43,500	20.0	25.8	Irreg. flaw	53.00
81,000	44,000	23.5	34.1	Irreg.	54.32

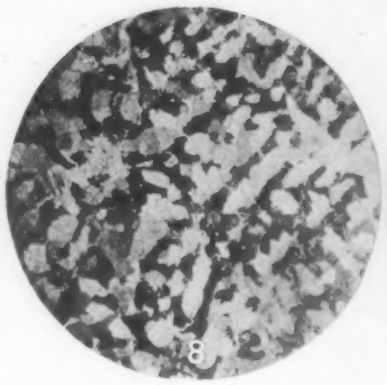
Microscopical Results.—The structure resulting from these bars is identical with that from the other class of steel or the same as Fig. 7. There is scarcely any difference between these and that resulting from the other class of steel under the same conditions of treatment and time.

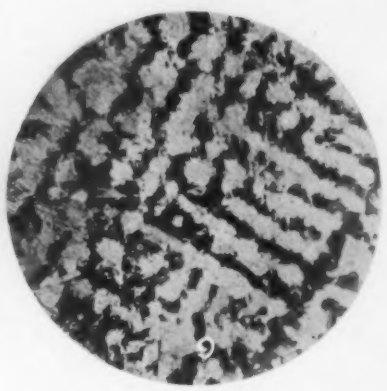
RECAPITULATION OF TESTS AND DEDUCTIONS

The foregoing tests are from the same heat of steel, and annealed at the same time in the same annealer, whether by the slow or the quick-cooling process.

Starting with an initial microstructure as represented by photomicrographs, Figs. 1 or 3,

which are characteristic of acid steel castings of thin section cooled quickly in the sand, the general proposition can be deduced that better and more uniform physical results are the rule, under either slow or quick cooling conditions, than when the initial microstructure is like that represented by photomicrographs, Figs. 2, 4 and 5. A comparison of the physical tests, Table 2 with Table 4, or Table 3 with Table 5, is ample proof of this statement. The "lace" or "net" structure, Figs. 1 or 3, is productive of better tests in all cases than the "angular" or "ingotism" structure, of Figs. 2, 4 and 5.





Figs. 8 and 9 Show the Condition of the Steel Represented by Figs. 4 and 5 After Annealing with Slow Cooling. They are not as uniform as Fig. 6. These are from the two tests in Table 4

LARGE CASTINGS FROM THE SAME HEAT

In further substantiation of this statement, several physical tests from wheel centers and other similar castings from the same and other heats in the same annealer were examined, both physically and microscopically. They are given in Table 6.

Table 6.—Physical Properties of Various Castings Annealed at the Same Time

Tensile Strength, Lb. per Sq. In.	Elastic Limit, Lb. per Sq. In.	Elongation in 2 In., per Cent	Reduction of Area, per Cent	Fracture
76,000	37,000	25.0	38.8	Irreg.
74,000	38,000	21.5	41.9	Irreg.
71,000	36,000	25.5	46.3	½ cup
76,000	43,000	25.5	40.3	Irreg.
74,000	39,000	26.0	40.3	Irreg.
76,000	41,000	28.5	43.4	Irreg.
73,000	38,000	24.0	41.9	Irreg.
73,000	37,000	28.5	46.3	½ cup

These are non-uniform, with some good and some poor. And photomicrographically they showed also a non-uniform crystalline structure, having large and small crystals, with consequent inner structural weakness, as in photomicrographs, Figs. 10 and 11. The original microstructure of these castings was of the "angular" or "ingotism" class.

VARIATION IN TESTS ON LOCOMOTIVE FRAMES

A further practical illustration of the effect of the initial structure on the physical properties of steel castings after annealing is furnished by the variation in the tests taken from the regular coupon cast solid on large locomotive engine frames and the small tie pieces cast between the various pedestals of the same castings. The regular coupon is considerably thicker than the tie pieces; they cool much more slowly, while the thin tie pieces cool quickly. The structure of the former is like that of Fig. 4 or even made up of larger crystals, while that from the tie pieces resembles the structure shown in Figs. 1 or 3. Annealed under the same conditions, while attached to the castings, and cooled slowly from a proper heat permeation, physical results given in Table 7 are obtained.

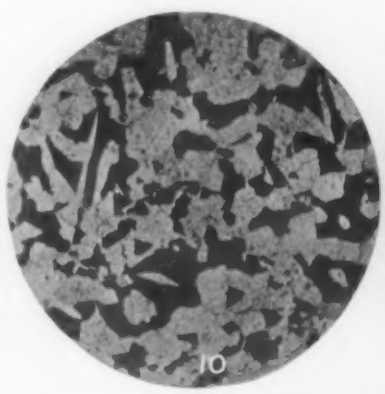
An analysis of these results reveals the fact that in most cases the tie pieces give the superior tests—superior in elongation, reduction of area and especially in elastic ratio. Their fractures are also better than those of the regular bars. Some foundries submit the tie pieces to inspectors, with the assurance of meeting specifications more certainly.

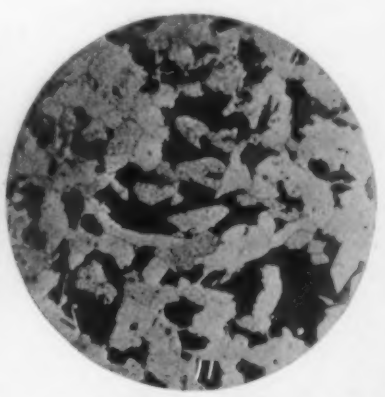
INITIAL STRUCTURE OF BASIC STEEL

The same principle of the effect of the initial structure on static properties is found in basic steel castings. I obtained two test bars from each of three heats of basic open-hearth steel from a large specialty foundry making bolsters, draw bars and knuckles. One bar from each heat was in the green condition as cast and the other one from each heat was annealed according to the regular practice of that foundry—quick cooling in the air from the proper annealing temperature. The original bars were not cast attached to a large casting, as in the case of some of the acid steel bars already discussed, nor were they cast so as to cool in the quickest manner practicable. They were attached to the under side of a solid block, 2 in. thick, and sawed off. This would give a moderate rate of cooling, though one fairly fast yet not slow enough to allow the formation of large patches of ferrite or pearlite, resulting in ingotism. The initial structure resulting from these conditions is shown in Fig. 12. There is a distinct absence of any large crystals or ingotism, while the small needle-like ones are abundant—it is a structure intermediary between those of Figs. 1 and 2 or 4. The structure after quick annealing is represented by the photomicrograph, Fig. 13—an excellent example, almost perfect, and nearly equal to a forging. The third green bar was annealed by the slow cooling method in

Table 7—Comparative Physical Properties of the Coupon and Tie Pieces From the Same Locomotive Frame Annealed at the Same Time

	Tensile Strength, Lb. per Sq. In	Elastic Limit, Lb. per Sq. In	Elongation, in 2 In., per Cent	Reduction of Area, per Cent	Fracture	Elastic Ratio, per Cent
1. Coupon	76,500	38,500	25.0	37.2	Irreg.	50.32
Tie Piece	72,500	41,500	27.5	41.9	½ cup	57.24
2. Coupon	77,000	38,500	22.0	27.5	Angular	50.00
Tie Piece	73,500	41,500	23.5	38.8	Angular	56.60
3. Coupon	75,000	39,000	23.0	34.1	Angular	52.00
Tie Piece	74,000	38,000	28.0	41.9	½ cup	51.35
4. Coupon	70,500	36,000	25.0	43.4	Irreg.	51.06
Tie Piece	72,500	38,500	28.0	43.4	½ cup	51.72





Figs. 10 and 11 Show the Structure of Steel Castings Having an Initial Structure Dominated by Considerable Ingotism. They are annealed by slow cooling. The physical properties are the first two tests in Table 6

Table 8.—Physical Properties of Green and Annealed Basic Open-Hearth Cast Steel Test Bars

	Tensile Strength, Lb. per Sq. In.	Elastic Limit, Lb. per Sq. In.	Elongation in 2 In., per Cent	Reduction of Area, per Cent	Fracture	Elastic Ratio, per Cent
1. Green, as cast	71,500	38,000	30.0	44.9	Irreg.	53.14
2. Quickly annealed	76,500	48,000	30.0	53.3	Cup	62.74
3. Green, as cast	64,000	35,000	32.5	46.3	Irreg.	55.47
4. Quickly annealed	72,000	45,000	31.0	49.2	Cup	62.50
5. Quickly annealed	75,500	49,000	31.0	48.3	Cup	64.9
6. Slowly annealed	65,000	34,000	29.0	43.4	Irreg.	52.3

the large annealer referred to, with the resulting structure shown in photomicrograph, Fig. 14—a startling contrast to that of Fig. 13. The physical results in each case are given in Table 8.

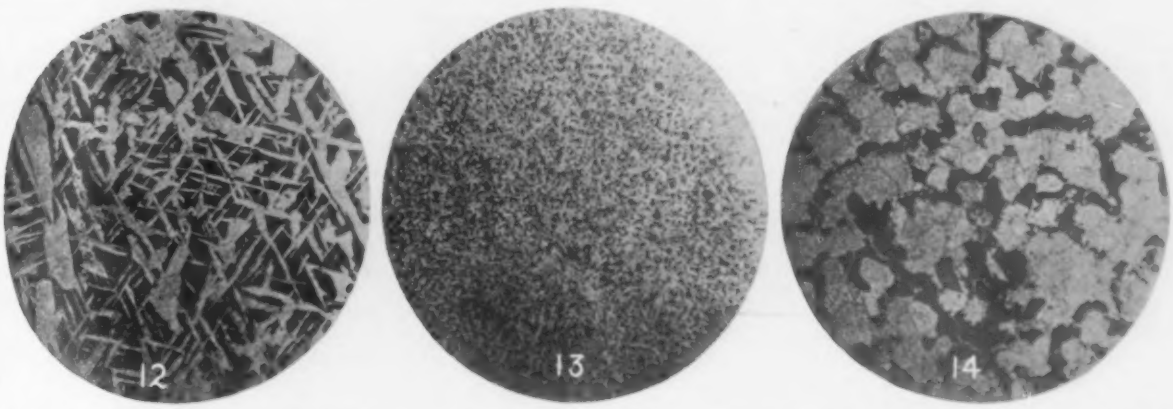


Fig. 12 is the Initial Structure of Basic Open Hearth Steel Castings of Moderate Section. It is a structure intermediary between Figs. 1, 2 and 4. This was taken from physical test No. 1 in Table 8. The same steel (Fig. 12) annealed by quick cooling is shown by Fig. 13 and its physical properties by test No. 2 in Table 8. Its structure is like a forging. Fig. 14 shows the structure of the same steel (Fig. 12) annealed by slow cooling and the radical difference in static properties between this and those of Fig. 13 is shown by test No. 6 in Table 8 which represents Fig. 14
All photomicrographs in this article are reduced about one-third from an original taken at about 100 diameters

These results, whether green or annealed, are superior to anything recorded in the first part of this paper in the case of acid steel castings. The effect of the initial fine structure is evident—the results in both methods of annealing are better than corresponding results from other steels. They are even better than any vanadium steel tests from acid open-hearth steel, as the high elastic ratio plainly shows.

The difference of 10,500 lb. per square inch in tensile strength, and 15,000 lb. per square inch in elastic limit and 12½ per cent in elastic ratio between the same steel annealed by quick cooling and by slow cooling is startling. The tests also show the fallacy of the old contention that annealing a steel reduces its tensile strength.

GENERAL CONCLUSIONS

The conclusions and explanations that follow from the data presented in the foregoing are:

The slower the cooling in the sand and the greater the bulk of metal, the more pronounced the presence of large crystals or octahedral structures called ingotism. Where this condition of ingotism is present, it cannot be corrected by a simple annealing at the recalescence point. It follows then that when one cools quickly in the sand and follows this by annealing at 1700 deg. Fahr. there is little or no ingotism to correct and better physical properties result. On the other hand, slow cooling in the sand sets up ingotism, which is not entirely destroyed by heating to 1700 deg. The static values will therefore be lower in direct proportion to the amount of ingotism present. It is stated that heating such steel to 1900 to 2000 deg. Fahr., the temperature usually necessary to destroy ingotism, the same values as for a similar steel cooled quickly in the sand or free from ingotism follow by normal annealing. Manifestly this remedy is impossible in most cases and not likely to be practised by a foundry with commercial results only in view.

The actual physical properties of steel castings are not revealed accurately by any test bar representing them. A heavy section will have different values than a thin one. The results are indicative of the general or average properties, but it is evident that the amount of ingotism present affects the results and that this amount varies in nearly every part of a casting.

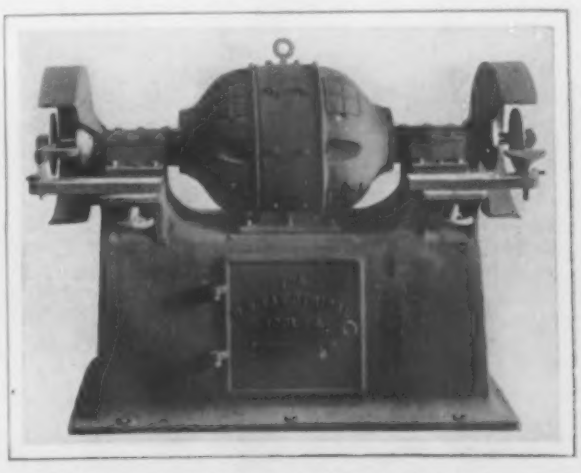
The absurdity of the insistence of some inspectors that the actual letter of the specifications be adhered to is manifest. Many heats have been rejected or referred to the Government or railroad if ½ per cent below the required elongation! It is now the practice of the most prominent railroad in the United States to make only rigid surface inspection of castings, abandoning almost entirely any physical tests.

Double-Spindle Heavy Grinding Machine

The United States Electrical Tool Company, Cincinnati, Ohio, has placed on the market a grinding machine especially for heavy grinding in machine and railroad shops or foundries. It is made in two sizes; the smaller of the two machines is illustrated.

The machine shown is driven by a 5-hp. motor and wheels 18 in. in diameter with a 3-in. face are carried at the ends of a 62-in. arbor. This machine operates at a speed of 1100 r.p.m. and weighs 1600 lb. Either direct or alternating current motors are supplied, the former being of the four-pole adjustable-speed type with laminated fields and interpoles. These motors are wound for 110, 220 or 550 volts. The alternating-current motors are of the single-speed type and are wound for use on 220, 440 or 600 volts, two- or three-phase current.

The larger machine has wheels 24 in. in diameter with a 4-in. face. This machine weighs 1850 lb. and is driven by a 7½-hp. motor.



A Double-Spindle Grinding Machine Intended for Heavy Work in Railroad and Machine Shops and Foundries

Machine Shop Equipment and Methods

Résumé of the More Important Developments in Machining Practices Resulting from the Introduction of High Speed Steel

A survey of the development of machine-shop equipment, methods and processes during the past twenty years formed the subject of two papers presented at the recent International Engineering Congress at San Francisco by E. R. Norris, director of manufacturing operations of the Westinghouse Mfg. Co., and H. F. L. Orcutt, of Rowington, Warwickshire, England. Chief among these developments was the discovery of high-speed steel, and the other improvements came largely as a result of the heavier duty imposed on machines by it.

IMPROVEMENTS IN CUTTING TOOLS

The change in the composition of high-speed steel from the time of the invention of Mushet steel (the first of the high-speed steels) to the present is shown in the following table.

	Mushet (Air Hardening)	Midvale (Date 1895)	Recent Make (with a Trace of of Nickel and Copper)
Tungsten	5.441	7.723	16.28
Chromium	0.398	1.830	4.26
Carbon	2.150	1.143	0.63
Manganese	1.578	0.180	0.10
Silicon	1.044	0.246	0.141
Phosphorus	....	0.023	0.008
Sulphur	....	0.008	0.018
Molybdenum	....	....	0.55
Vanadium	....	....	0.26
Cobalt	....	....	3.47

In the earlier days the introduction of high-speed steel was retarded by the high cost of the investment. Attempts have been made to reduce this by the adoption of tool-holders and the development of methods of welding high-speed steel tips to carbon-steel shanks. A table given by Mr. Norris, illustrating the relative cost of solid, butt welded, and welded tip high-speed tools, showed that the total cost during the life of the tool, including six reforgings and sixty-nine grindings, was for the three types as follows: Solid tool, $9.11; butt-welded, $8.17; tip welded, $9.21. The salvage on the tool steel after the tool had been used up reduced the total net cost to the following figures: Solid tool, $8.04; butt-welded tool, $8.67; tip welded tool, $9.17.

High-speed steels are now used for turning, boring, planing, shaping, milling, drilling and punching, the most noteworthy exceptions to this rule being found in shops where the product consists chiefly of articles made from the softer metals or their alloys, in which cases the carbon steels are often preferred. High-speed steels are also being used with success in the manufacture of slotting dies. The following is a record of tests made with dies of carbon steel and high-speed steel in punching of notches in sheet steel 0.0172 in. thick on an automatic notching machine at the rate of 300 notches per minute. Carbon and high-speed steels were run at the same speeds, and it was found that carbon steel dies required grinding oftener than the high-speed steel dies in the ratio of 2.4 to 1. At the end of the tenth grinding the high-speed steel die had punched 1,239,000 notches, whereas the carbon steel die had punched 506,000 notches. The relative cost of carbon and high-speed steel dies was found from this and similar tests to be, for a given production, approximately as 2:1.

The latest development in cutting material is that of stellite, which has the following composition: Cocalt, 52.03; chromium, 29.36; tungsten, 12.71; iron, 5.35; nickel, 0.45; manganese, 0.24; silicon, 0.09; molybdenum, trace.

As stellite cannot be forged, rolled or machined, is extremely brittle, and as tools made from it must be well supported close to their cutting edges, its uses are at present somewhat limited.

Stellite tips may be brazed or electrically welded to shanks of carbon steel, and when so treated may be used until repeated grindings render the stellite very thin.

Under favorable circumstances, cutting speeds may be greatly increased by the substitution of stellite for high-speed steel. Cases are on record where cutting speeds on machinery steel have been quadrupled, and cutting speeds as high as 300 ft. per minute have been used in cast iron.

IMPROVEMENTS IN MACHINE-TOOL DESIGN

The more important improvements of machine tool design during the past two decades are: 1. Single pulley drive. 2. Change gear boxes. 3. Independent motor drive. 4. Ball and roller bearings. 5. Speeding up of idle movements, quick power returns and automatic movements when not cutting. 6. Provision for cutting and cooling fluids. 7. Provision for better lubrication. 8. Increased precision. 9. Chain drive. 10. Rigidity in design.

Most of these changes have been due to the introduction of high-speed steel. To take full advantage of this material the following somewhat revolutionary requirements had to be met:

Higher cutting speeds must be maintained. Great rigidity is necessary. Feed mechanisms must be revised to give greater range, and higher velocities, more power and positive drives are essential. Increased accuracy is desirable to withstand greater wear of rapid motions. Especially, attention must be given to supply and control of cutting fluids. A machine tool which does not possess features of design and workmanship covering the above details should not be purchased, if the full benefits of the use of high-speed steel are desired.

In commenting on the various improvements outlined above, Mr. Orcutt made the following points:

The Single Pulley Drive is necessary to rapid production except where only very light cuts are called for. It makes possible a strong belt pull at all speeds. Combined with a good gear box, it covers a large range of speeds. In most cases countershafts can be dispensed with as well as belting.

Feed Change Gear Boxes usually take the place of groups of small cone pulleys and numerous belts. They give positive motions, quickly altered, and an increased variety of feeds.

Independent Motor Drives are more applicable to larger machine tools than to small. They assist in locating and grouping of heavier machinery, making possible the most economic and methodical arrangements of plant regardless of main shaft drives. They are not of much value usually to small machines, which are as a rule arranged in groups which can be driven from a common motor and line shaft. The expense of individual motor drive is hardly warranted in small machinery.

The Speeding up of Idle Movements has not had the attention it deserves. As actual cutting speeds increase, the time between cuts becomes relatively of much importance. When machine cuts can be made four and five times faster (even more) with high speed steel than with ordinary carbon steel, it is clearly obvious the next stage in which "machine times" can be reduced is in the manipulation and handling of the machine. The ideal is entirely automatic movements of the work table and tool holders at the fastest possible speeds when machines are not cutting.

Few machine tools are properly arranged for the supply and control of an ample quantity of cutting fluids, either oil or compounds. In spite of the common knowledge that cuts can be increased by a large percentage by the use of a large volume of fluid manufacturers continue to supply machine tools with little or entirely inadequate provision in this respect. A lathe, drilling or a milling machine is really difficult to find properly designed in this detail. [Recent developments in milling machine practice have taken advantage of this principle. See excerpt from Mr. Norris's paper below.—Editor IRON AGE.]

Lubrication is now given more attention than formerly. Good provision is necessary in the modern machine with high speeds, close fits and complicated mechanisms.

Undoubtedly the general trend is toward better workman-

ship and higher precision. High speed steel has forced improvement in this respect. A machine with poor workmanship cannot stand up to the strain of rapid motions, high spindle velocities and heavy bearing pressures.

Rigidity is still a much neglected feature. Good work cannot be produced rapidly on flimsy, chattering machines. It is not usually appreciated that massive construction is essential to rapid output in many cases even when comparatively light cuts are taken.

The Chain Drive has proven its efficiency and practicability. It is positive, long-lived, stands high speeds, is cheap and silent. It will stand duties not yet generally appreciated by machine tool makers.

DEVELOPMENTS IN MILLING MACHINE PRACTICE

Mr. Norris cites as the most important advance in milling-machine work the development of "stream lubrication," which involves the application of exceedingly large quantities of cutting compound directly on the cutter by means of a hood. The experiments noted below show the great value of this improvement. By using stream lubrication while cutting the teeth of a long pinion it was possible to increase the speed 71 per cent and to increase the feed 164 per cent. The speed at which keyways in chrome-nickel steel shafts were milled was increased 36 per cent and the feed 90 per cent. By the same means the speed for milling the teeth of machinery steel sprockets was increased 86 per cent and the feed 50 per cent.

Commenting further on this feature, Mr. Norris wrote as follows:

> Stream lubrication is being used to advantage in cases where, owing to limited capacity of the machine, speeds and feeds cannot be increased. The following is an instance of such a case. In milling grooves to form bars of "H" shaped section, it was possible to mill 300 pieces for each grinding of the cutter—stream lubrication being used—whereas, with the ordinary lubrication, the cutter had to be ground after 15 or 20 pieces.
>
> While stream lubrication gives excellent results on steel of various kinds, it is not always satisfactory when used on cast iron. This appears to be the case where the hard skin of cast iron must be encountered at all parts of the traverse, as, for instance, where the cutter is wider than the surface of the casting, and the vertical edges of the casting skin are presented to the cutter at two places only, which are separated by a distance equal to the width of the casting.
>
> Since the cutting speeds and feeds have been greatly increased, the ratio which the handling time bears to the total time of any milling operation will be greatly increased, unless improved handling and chucking facilities commensurate with the increased cutting capacity be installed. It is also evident that the highest efficiency can be obtained from operator and machine, only when the cutting proceeds continuously. This condition may be obtained, approximately, by what has been called the "continuous" method of operation. The "continuous" method may be used where the work is of such a size and shape that a circular milling attachment or a machine having two or more revolving tables can be used.

GRINDING MACHINE METHODS

According to Mr. Norris considerable saving is being effected by the use of disc grinders on many flat surfaces that were formerly milled. This is more noticeable in dealing with castings that are liable to be chilled and brittle. Grinding also possesses decided advantages where the shape of the casting or forging is such that, in order to prevent springing, great care is necessary in chucking or clamping the work in the milling machine.

Mr. Orcutt says, regarding external cylindrical grinding:

> Its successful use involves the correct combination of (1) the most suitable machine, (2) the most suitable grinding wheels, (3) the intelligent use of the trueing diamond.
>
> The modern shop, to derive the immense benefits of the grinding machine of to-day, must work closely with wheel makers to secure the right wheel for various classes of work. It must train men in the art of trueing and manipulating the wheel. There is not sufficient attention given to the training of expert grinding men who in the future will rank in importance with the turner, fitter and the tool maker.
>
> The operation of cylindrical grinding is looked upon by most manufacturers as one to be adopted only where extreme accuracy is required. In reality the modern grinding machine combined with fast roughing lathe is one of the most economical machines known for producing ordinary cylindrical parts. It is believed that the savings which can be made in maintenance, repairs and running costs due directly to the accurate finish possible only on the grinding machine are scarcely realized. The recent experience of an important concern who adopted grinding as a finishing process is most suggestive. It is recorded that savings in repair to soft metal bearings amounting to $3,000 per month were made in one concern after the cylindrical bearings were finish-ground instead of being turned.

Another grinding development of considerable interest is that of gear-tooth grinding. This enables the production of accurate hardened gears, and reduces gear cutting to a gashing process of only ordinary milling practice accuracy. It also permits the use of gear materials which were formerly impracticable, such as manganese-steel. Still another development is that of cutting-off grinding, which utilizes a thin abrasive wheel in a special machine. This process is useful in cutting alloyed metals which it would be difficult to machine with ordinary tool steel.

THE ADVANTAGES OF A LABORATORY

A development which is more in the future than in the past is the more extensive use of the laboratory.

Undoubtedly the modern shop is beginning to realize the value of the laboratory (1) as a guide in the selection of materials and (2) as an assistant in compiling practical specifications and inspection data. Large concerns can support, with profit, their own scientific staff. Small concerns can make use of the numerous central laboratories which are well equipped and staffed, and which exist in nearly every engineering center. The results of taking advantage of the scientific resources referred to should be:

1. Selection of the best material for specified purposes.
2. The purchase of the cheapest material for this purpose.
3. The scientific inspection of material as it comes from the supplier so as to insure a uniform quality.
4. A scientific and correct routine of heat treatment of material, hardening, annealing and tempering.

MANAGEMENT

Mr. Orcutt, in concluding his paper, pointed out that the successful (i. e., profitable) use of the best mechanical outfit it dependent on good management.

We can point to many examples of elaborately equipped factories working with little or no profit, to many badly equipped factories making money. Instances of well equipped works operated under scientific management and in complete harmony with the sales department, and paying dividends, are not so common. A scientifically managed plant is nothing more nor less than one in which maximum output is secured at the lowest cost. The elements of such a management are known and tabulated. Their practical working is demonstrated. A complete working establishment is a rarity. A machine can be bought, paid for, delivered, set up and made to turn out work. Scientific management cannot be passed over the counter for a fixed price. It requires talent, backing and co-operation to insure its successful working. *It is understood least of all by those who are in leading positions in our industrial concerns, on whom original initiative falls.*

Generally speaking, mechanical outfit proportionally receives too much attention as a means of increasing efficiency. In nine factories out of ten costs can be reduced and output increased by scientifically operating existing plant with much more profitable returns than are possible by installing new machinery. It is not putting it too strongly to state that it is practically impossible, in any other manner than that pointed out—by scienific management—to reap the full benefit of high-speed steel and of our highly developed mechanical outfit.

In respect to commercial management and sales work the "modern" shop makes exacting demands.

The thoroughly "modern" shop is one in which we find the best mechanical equipment operated under scientific management, controlled by a commercial policy fully appreciating engineering requirements.

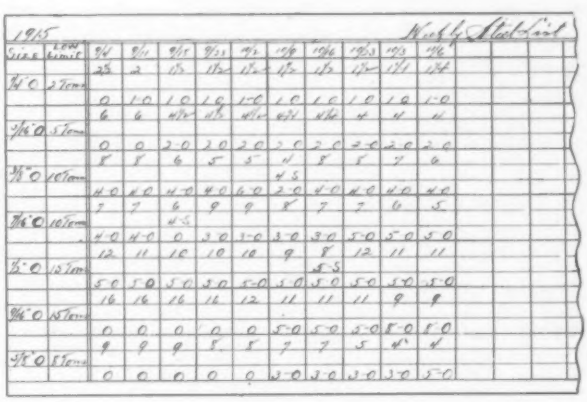
Anticipating Buying Emergencies

Information Needed by the Purchasing Agent to Guard Against Shortages in Material Required by the Factory

BY H. A. RUSSELL

There are frequently times when the question of price is an insignificant factor, as compared with the need of securing the desired material, supplies, equipment or repair parts for some machine that has broken down in the midst of a rush period. The question of whether to have a heavy shipment come forward by express or freight can usually be decided in a few minutes. The important item is to know the one best and quickest method of securing the article needed. The purchasing department must look ahead, not only of the requirements of the factory but also of the prospectve orders, which the sales department is endeavoring to secure. The greater the problem of obtaining satisfactory deliveries, the more evident will become the efficiency or non-efficiency of the purchasing department. Six months ago was none to soon to prepare for the present congested condition of the steel mills.

First, let us consider the question of anticipating the requirements of materials which later become a part of the finished product. If the product consists of standard lines, placed on the market from year to year, the purchase records should clearly and accurately indicate the variations in price from time to time, the quantity used during a season or year, the standard quality used and possible substitutes, the list of sellers of each item from whom purchases have actually been made and a further list of sellers from whom the same items can be obtained. With such records the buyer has a solid foundation on which to build up his purchase program for the period ahead, and it matters very little whether the period is to be of six months or longer duration.



Record of Steel Ordered

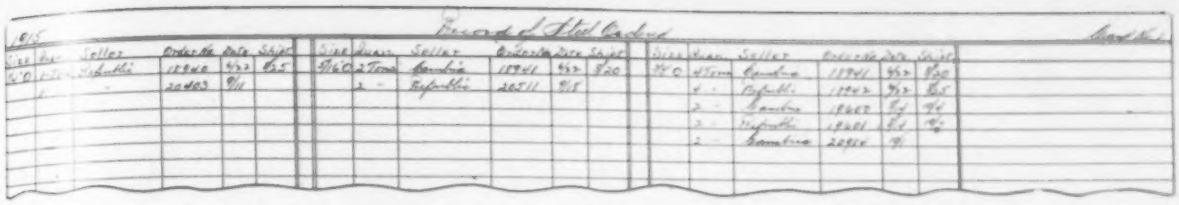
Supposing that after the buyer has taken every precaution to have the materials coming along, as the factory needs may demand, and through some cause, beyond the control of the seller, shipment will be considerably delayed. Does the buyer then throw up his hands and pass the information along to the production department, or does he get busy and secure the material elsewhere? It depends to a great extent on the amount of precautionary work that has been done beforehand.

We all know that there are certain items for which no reasonable substitutes are available, but is it not a fact that the proportion of these items is comparatively small? And is it not also a fact that even this proportion can be considerably reduced, if we keep our eyes open and constantly try out and experiment with new things? In our product we use a number of sections. To secure a few tons of any of these may take many months. When our order is sent in to the mill it is entered and held until sufficient tonnage has been received, from other sources, to justify a rolling. Usually this procedure is satisfactory because we have anticipated our requirements. Supposing, however, that the rolling was delayed longer than usual and it was necessary for us to secure this material or lose a number of orders. Our first step in an instance of this kind would be to look over the list of possible substitutes and get in touch with the makers, with as little delay as possible, and in the majority of instances we have been able to secure the substitute section in time for the factory needs. The question of cost does not enter into the matter as much as the question of whether the substitute section will give as good service as the one it replaces.

Now let us consider the proposition of making use of the many large stocks of steel bars, angles, channels, sheets and plates, etc., that are carried in all the larger cities, and any item of which can be usually shipped the same day up to varying limits of tonnage. Almost all of the warehouses issue monthly stock lists and these, when received, should be properly filed so that they are instantly accessible. As the latest issue comes to hand, the previous copy must be destroyed; otherwise reference may be made to what will then be an incorrect list and valuable time may be lost. Where the lengths carried in the warehouse are at all suitable for the requirements, delay will be avoided by specifying these stock lengths. At times when the stock lengths will cause too much waste, as in the instance of large sizes of I-beams, channels, etc., the best plan is to specify the exact length, and as these sections are generally carried in various lengths, from a few feet up to 40 ft. or even 50 ft. long, the small quantity ordered can be cut from the longer pieces and still leave a desirable length on hand. As the warehouse price, at the present date, is from ½c. to almost 1c. per pound (including freight, which of course must be added to arrive at a true figure) higher than prevailing contracts, the quantities ordered from stock houses should be based, as closely as possible, on the amount of tonnage required to keep factory orders on the move, until a further supply of that particular size will be received from the mill.

When an inquiry is received for certain machines, which are not a part of the standard line, and the space of time allowed for shipment would not permit of securing the material from your regular mill, your quotation should be based on warehouse prices. Under present conditions it is extremely unlikely that your competitors will be able to secure the desired materials any sooner than you can.

As I have remarked before, the factory stockrooms should be under the control of the purchas-



Perpetual Weekly Inventory Showing Quantity of Steel on Hand, the Tonnage Shipped but Not Received, and the Total Tonnage Ordered but Unshipped

ing department, working in conjunction with the production department. The stocks of the various items should be governed by a low and high limit for each item. These limits are to be set by the purchasing department and can only be changed by its instructions. When materials and supplies are readily obtainable and deliveries are prompt, the high limits can be reduced, when the securing of these items is a question of weeks, instead of days, the limit must be raised. These limits should be changed only upon written instructions being received from the purchasing department. Our usual method of notifying the stockroom keepers of a change is to send them a typewritten memorandum, somewhat as follows: "Until further notice, reduce (or raise) the low (or high) limits on carriage and machine bolts 20 per cent." To the man in charge of the stock of steel bars, slabs, etc., and the sizes of which are used for so many different machines that we carry the different items on a low limit basis, we send each week a list comprising about thirty of the leading sizes and then receive his report of the quantities on hand. In the office we record this information as received and by comparing the quantities on hand with the low limits that have been set, we are enabled to have a complete grasp on this stock. As soon as the stock on hand of any of these items falls below the limit that has been set we refer to the card which shows the quantities of each item specified with the mill, and hurry up shipment of such items as are necessary. These low limits are changed also as conditions necessitate.

This perpetual inventory of stock on hand and list of orders placed and material en route is kept in the purchasing department, and consequently the responsibility of keeping the stock ahead of requirements rests there also. A reproduction of this card shows the method followed of keeping the perpetual weekly inventory. The top figure in each section indicates the quantity on hand in net tons, the second figure indicates the tonnage shipped but not yet received, or if in a car on the switch not yet unloaded, and the third figure indicates the total tonnage of the item ordered from the several mills and unshipped. The method of recording the amount of the tonnage specified of each of these items, also the order number, date and seller are also shown, and the extreme right-hand column of each section provides a place to indicate the date the item was shipped. We have not provided a space to note the promise of shipment, as we preferred to note this on the copy of the order. It will probably be noted that we divide the tonnage of the different sizes between the mills. We have found it advantageous to do so, for the reason that often one of the mills will have a rolling of a size about the time that we need the material. As a proof that it pays well to carefully watch each item, I would instance our own particular case. Several years ago, when mill deliveries were from three to six months behind orders and our total tonnage for the year was over 2000 tons, it was only necessary to order from the different stock houses a total of less than 20 tons, or less than 1 per cent of the requirements. Furthermore, no shipments of customers' orders were delayed, nor was the factory held up at any point in getting out the maximum output. Of course daily consultation with the departmental foremen was a necessary part of the routine. It might be well to state here that these consultations are usually handled by the production department, who, in a brief summary, report to the purchasing department.

Where the product is practically uniform from year to year and the estimated sales for the year ahead can be based on the sales for the previous years, taken in conjunction with the outlook for the coming period, it is only a matter of detail to work out the quantities of all the materials needed to manufacture the required number of machines. Here the buyer has a great opportunity to tie up a large amount of non-producing capital, unless he is familiar with the selling season for each group of machines. It is very easy to order many items which may not be needed for months ahead, and the amount of money involved could be earning at least the average banking rate of interest, even providing it could not be used to better advantage elsewhere. Besides if the material is received too far in advance of actual needs it will take up storage room which could be used for other quicker

The Weekly Boiler Report Giving the Number of Boilers Completed, Partly Finished and for Which Plate Has Been Ordered That Must Be Carried on Hand Over and Above Customers' Orders and the Quantities on Hand at Various Dates

moving items. Only by exercising his best judgment may the buyer satisfy himself that it is wiser to order materials a considerable length of time ahead of requirements, in order to take advantage of a low-priced contract that it about to expire.

The card showing the method of keeping the boiler stock up to the low limits, which in this instance are set by the sales, purchasing and production departments, working in unison, is also reproduced. The figures in the second column indicate the quantity of boilers of each size and style which are to be carried on hand over and above active customers' orders. These low limits do not, in all instances, indicate finished boilers ready to ship but rather the number of finished boilers, plus the boilers partly finished, plus the quanity of plate on hand from which each size and style can be later constructed.

The figures in the remaining columns show the stock on hand, finished and partly finished and plate, at each of the dates shown at the top of the columns. This card gives an instantaneous reference, not only for the stock on hand, but also the number of each size and style sold in a given period. If the figures do not indicate a rapid movement of any particular size, the low limits can be reduced. However, if they indicate a movement above normal the limits are raised, to be advanced further if necessary. As will readily be seen the record can never be more than a week behind the actual facts. For the purpose of keeping these two perpetual inventories, steel bars and boilers, we use a card measuring 5 x 14 in. A card of this size, while special, affords a comparison for a much longer period than the usual standard 5 x 8-in. card. In fact we use these 5 x 14-in. cards for a variety of purposes, such as recording the amount and cost of electric power and light used monthly and yearly, the amount and cost of coal, pig iron and scrap, purchased yearly, etc. The greater the quantity of these records the buyer has at his command the more intelligently can he foresee the needs of the plant.

At times quick action is needed to secure a repair part for some machine that has broken down in the middle of a busy season. While certain important parts of the larger machines are carried in reserve, it is hardly possible to carry a duplicate stock of all the parts that may break. When we purchase new equipment a most complete record is made of each machine; the seller's name and address, the maker's shop number and the size and style of the machine, a list of all the loose parts which are regular or special, the date and number of the invoice, the purchase order number and the maker's factory order number, if given. All these are a part of the record. It is advisable to have the factory address also. It may very well happen that if this information is at hand, a considerable delay can be avoided in securing the duplicate parts. For instance, if a breakdown occurs late in the afternoon a telegram can be sent at once if the purchase record is complete, and shipment of the parts can usually be made the same day, but if valuable time must be wasted in locating the original order or the invoice the telegram will reach its destination too late to permit of shipment being made until the following day. A large percentage of machines are sold through agencies or branch offices located many miles from the factory, so it can readily be seen that the items of factory address and order number are of real importance. Often the foreman is undecided whether to have the operator report for work in the morning or lay off until word is sent to him that the machine is ready for use again. A request for a reply to the telegram or a long-distance telephone call will generally settle this point. In any event the first definite information should be passed along without delay, not only to the foreman but to the production department as well.

Another emergency that often confronts the buyer is the purchase of a new line, possibly the result of a recent invention, or it may be a product which has been upon the market for a number of years, but up to the time the emergency arises the buyer has not been called upon to add it to his list of purchases. To be prepared to handle these promptly and intelligently the file of Buyers' Guides, Commercial Registers, etc., should be complete and up to date. Circulars, clippings and memoranda should be carefully filed and, where necessary, indexed, if they in any way refer to products which are then, or may become later, a corporate part of the manufactured lines.

Customs Decision

SAFETY FUSES

The Bethlehem Steel Company, South Bethlehem, Pa., has for the second time been upheld by the Board of United States General Appraisers in the claim that safety fuses imported under the tariff act of 1909 are properly dutiable at 35 per cent under the specific provision in that law for "safety fuses." This issue, while arising under the old tariff, has been regarded as important by both the Government and the steel company owing to the fact that a decision under the act of 1909 would have the effect of settling the classification under the present act, although the rates of duty on such importations would be different. The case first came before the board last April when a decision was arrived at holding that the collector of customs at Philadelphia erred in returning the fuses at 45 per cent as "manufactures of metal not specially provided for."

After consideration of the evidence adduced at the trial, the board upheld the claim for the lower rate, and ordered a reversal of the custom house classification. Assistant Attorney General Hanson, of the Department of Justice, however, asked for a rehearing on the ground that newly discovered evidence as to the character of the fuses might convince the board that a mistake had been made in finding in favor of the importer. While the rehearing was granted and the Government's new testimony put in the record, Judge Fischer, in his decision for the board, said that the additional testimony did not warrant a reversal of the earlier finding in favor of the importer.

The Goodyear Tire & Rubber Company, Akron, Ohio, describes its Motz cushion tire, intended for cars and trucks up to 3000 lb. capacity as a compromise between a pneumatic and a solid tire, its resiliency closely approaching that of a pneumatic and its durability that of a solid. The characteristics which distinguish it from other types of cushion and solid tires are dual treads, slantwise bridges and undercut sides. Records show that these tires have averaged better than 9000 miles per set. "Yet," says the company, "the mileage attained is really a small part of the service rendered. Their resiliency minimizes jolts, reduces vibrations, checks depreciation and renders repair cost negligible. These things must be taken into consideration when computing their efficiency."

At a meeting of creditors of the Prime Steel Company, Milwaukee, Wis., held Nov. 26, a second dividend of 15 per cent was declared and ordered paid. It was stated at the meeting that the Harris Brothers, Chicago, who purchased the two foundries operated by the Prime Company, will not continue the business, but are dismantling the works and selling the stock and equipment in parcels.

An Investigation of Ladle Test Ingots*

Unsoundness Renders Analysis Inaccurate—Advantages of Adding Aluminum for the Prevention of Segregation and Sponginess

A recent order for the inspection of open-hearth steel rails was of such a character as to demand a check for the manufacturer's chemical analysis of each heat represented, and the results of our analyses differed so widely from those reported by the mill that it was finally deemed advisable to make some investigation of matters pertaining to ladle test ingots, and principally to the possibilities of their segregation and soundness.

What has been known to exist for a long time became apparent at the outset of our investigation, and was simply that ladle test ingots were subject to unsoundness and segregation exactly as are all large ingots, the only difference being one of degree. Obviously, as long as this condition exists, it

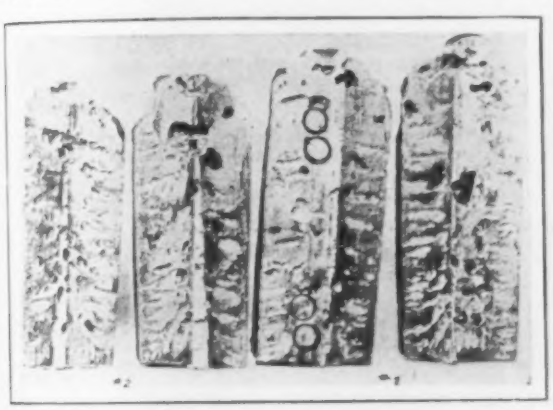


Fig. 1—Ladle Test Ingots of Steel as Poured

is impossible to expect analyses of the same test ingot by different chemists to agree within the limits of possible chemical error unless drillings for the samples are taken with special care and mixed and divided so as to insure both chemists working on identical lots. But of much greater importance is the fact that when the ladle test ingot is segregated and unsound, the drillings taken from it may not be representative of the steel or heat as a whole, and the reported results are therefore misleading and inaccurate. Thus a heat of steel can be reported as 0.60 per cent carbon, while as a matter of fact, it was actually 0.75 per cent, and *vice versa*, it might be reported as 0.75 per cent and really be 0.60 per cent. These figures are not exaggerations but are the differences reported by two chemists on drillings from the same test ingot.

This subject is not a new one, and but recently a committee of the United States Steel Corporation has made a considerable study of ladle test ingots which has resulted in prescribing certain conditions for the guidance of their mills; and the American Society for Testing Materials has a committee at the present time, co-operating with the Government Bureau of Standards in an investigation relating to ladle test ingots. Notwithstanding such steps as have been taken we feel that certain fundamental facts are already established, and if the consistent adoption of practice based on these facts could be attained by immediate action a great benefit would be accomplished.

At the mill at which we were engaged, as mentioned above, the ladle test ingot mold was about 2½ in. square at the top, 2 in. square at the bottom and 5 in. high. Depending on the amount of steel poured into it and the extent of its boiling, or raising up of the top, the resulting ingots varied in height from 3 to 6 in., and when they were drilled, in order to obtain the sample for analysis, many cavities were encountered. In some instances it became necessary to take drillings from two different locations on the same ingot and in such cases the chemical results varied by as much as 0.15 per cent carbon (by combustion). The character of these ingots when split open is as shown by Figs. 1 and 2, and some chemical results on sample drillings from them are given below, although the difference in these cases happens to be small.

These samples of ladle test ingots were taken from the same heat of open-hearth rail steel and split open to show the interior structure. No. 1 was taken from the second large ingot cast; No. 2 was taken from the sixth large ingot cast; No. 3 was taken from the thirteenth (and last) large ingot cast; No. 4 was taken from the thirteenth large ingot cast but had ferrosilicon added to it as it was being cast.

Analysis on Drillings

	C	P	Mn	S	Si
Mill ladle test ingot	0.71	0.012	0.81	0.030	0.079
Inside top of No. 1 (as indicated by circles)	0.71	0.021	..	...	...
Inside bottom of No. 1 (as indicated by circles)	0.659	0.018	..	...	...
Outside top of No. 1	0.64	0.016	..	...	...
Outside bottom of No. 1	0.637	0.017	..	...	...
Outside bottom of No. 2	0.63	0.018	..	...	...
Outside bottom of No. 3	0.636	0.018	..	...	...
Outside bottom of No. 4	0.64	0.019	..	...	0.42

Obviously the metal near the outside of the ingots differed from that near the inside, and the location of the drillings with respect to the height, particularly, also gave different results. It will be noted with interest that the degree of porosity is apparently somewhat greater in the ingot from the first part of the heat than that from the last part of the heat, and further, that the addition of the deoxidizing agent, ferrosilicon, experimentally in one case, made that ingot absolutely sound for most of its height.

Nearly every rail mill has had a style of ladle test ingot of its own, and the shapes and dimensions of those in vogue about two years ago are shown in Fig. 3. Some of these have been changed

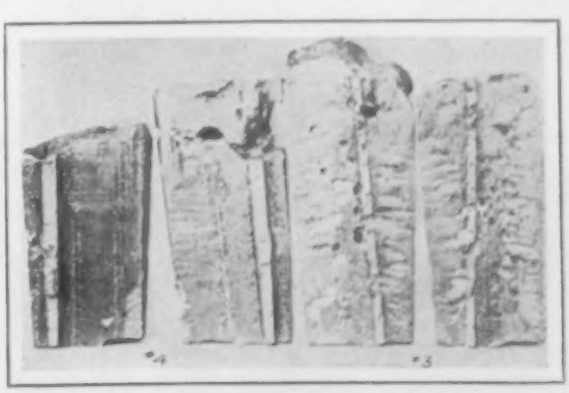


Fig. 2—Ladle Test Ingot No. 3 Was Taken of Steel as Poured and No. 4 Had Ferrosilicon Added to It

*Rail report August, 1915, prepared by Robert W. Hunt & Co., for the American Railway Engineering Association.

since that time, and Figs. 4, 5, 6 and 7 show a collection of various ingots, representing rail steel, that have been lately cast and split open in order to show their interior condition. The ingots have been split in the center and the half section showing unsoundness and piping is shown together with the outside half elevation. The illustrations are about one-third full size. It will be observed that many are very unsound and no doubt in such cases segregated. Those that are sound, except for the pipe, have had aluminum added and with the result that a quiet setting steel free from blow holes has been obtained.

Soundness—viz.: freedom from blow holes, etc. —is a very important property for ladle test ingots to possess. In the first place, the more unsound one is, the more it is inclined to be segregated, and secondly, in drilling steel that is full of blow holes, minute particles break off from the sides of the holes and render the chemical determination for carbon by combustion methods more difficult of accuracy than when thin flake-like drillings are furnished.

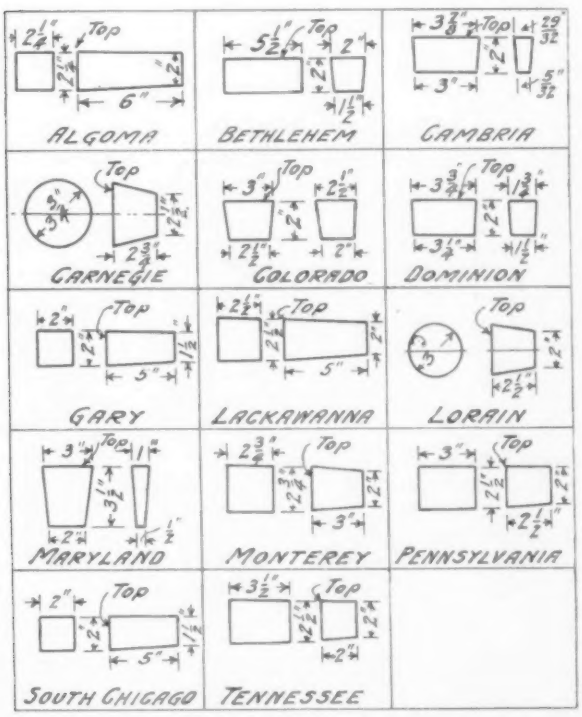
From the results shown in Figs. 4, 5, 6 and 7, it is quite evident that the soundness of the test ingot is not predicated by its shape. At the same time it is logical to regard a thin slab-like shape as preferable, because of its tendency to chill quickly and thus solidify with a minimum degree of segregation. The disadvantage of this shape of test ingot lies principally in the difficulty of obtaining sufficient drillings to provide for the requisite number of analyses.

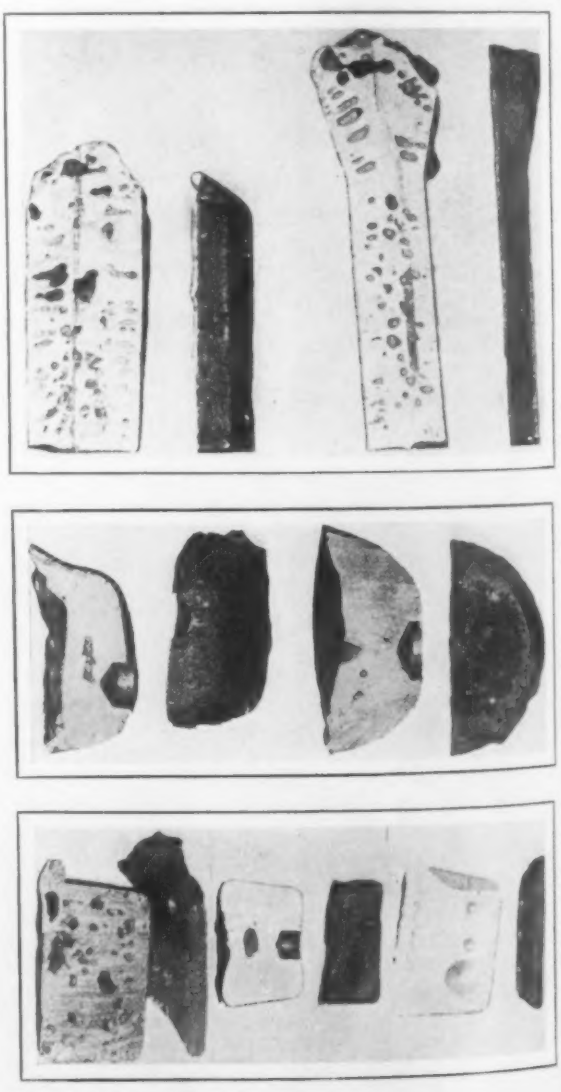
The addition of a deoxidizing agent to insure a sound setting steel and a ladle test ingot free from blow holes is more or less common practice at some mills, and commercially pure aluminum in the form of pellets is admirably adapted for this purpose. Fig. 8 shows two ladle test ingots (about one-third size) cast in similar molds of as nearly identical steel as it is possible to obtain from the stream filling a single large mold. In one case (sample A) no aluminum was used, with the result that the ingot was spongy, boiled badly in the mold and showed considerable segregation on analyses of different samples from the exterior and the interior. In the other cases (sample B) the addition of a little aluminum made the metal set absolutely sound, excepting for the inevitable pipe, while analyses of drillings from corresponding locations as in the first case indicated that the segregation had been materially reduced and without appreciable influence on the amount of carbon present.

Both ingots were drilled at the locations shown, from the outside in and also on the inside. Thus there were six sets of drillings in each case. Results for carbon (by combustion) are:

Ingot	*Location*			
	No. 1	No. 2	No. 3	Average
Without aluminum—outside..	0.692	0.663	0.708	0.683
Without aluminum—inside...	0.640	0.686	0.720	0.682
With aluminum—outside.....	0.667	0.715	0.695	0.692
With aluminum—inside.....	0.700	0.686	0.700	0.695

	With Aluminum	Without Aluminum
Greatest difference outside samples.....	0.048	0.045
Greatest difference inside samples.....	0.014	0.08
Greatest difference all samples.....	0.048	0.08





Figs. 3, 4, 5, 6 and 7—Samples of Ladle Test Ingots

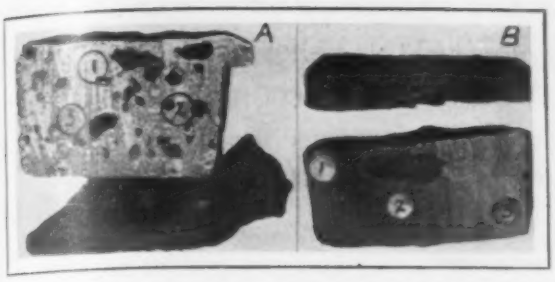


Fig. 8—Ladle Test Ingots: *A*, as Poured, and *B*, Same Steel with Aluminum

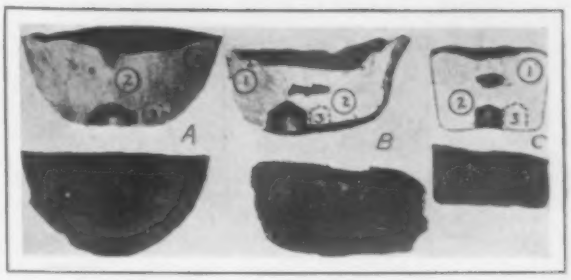


Fig. 9—Samples of Ladle Test Ingots to Which Aluminum Had Been Added

From the above it would appear that aluminum acted toward retarding segregation by causing the metal to set solid, and it does not appreciably raise the carbon by so doing.

The efficacy of aluminum additions is further shown by reference to Fig. 9, which illustrates three ladle test ingots (about one-third size) to which aluminum was added at the time of pouring. The types of ladle test ingots there given are slow cooling because of their shapes and dimensions, and much reason exists therefore, for anticipating spongy and segregated metal. Yet in every instance the steel, from the three widely separated mills represented and which ordinarily make what may be termed a low silicon or raising steel, has been made to set sound and clean by using aluminum. Careful analyses of these ingots on samples taken at various locations fail to detect any segregation beyond the limits of chemical error.

Below are given results for carbon (by combustion) on drillings taken as shown; No. 3 in each case being from the outside in as the ingot would ordinarily be drilled, and Nos. 1 and 2 being on the inside in order to show segregation, if any:

	No. 1	No. 2	No. 3
Ingot A	0.634	0.610	0.607
Ingot B	0.706	0.728	0.710
Ingot C	0.572	0.563	0.574

From the three analyses made on each ingot it is clear that little, if any, segregation exists in either case.

Based on the experience of the past, therefore, we feel constrained to recommend such additions to rail specifications as will provide:

First. A standard shape and size for ladle test ingots with directions as to the size of drill and location of the borings on which the analysis is made.

Second. The addition of aluminum, preferably in the dipper, when necessary to insure a sound setting steel in the ladle test ingot with freedom from blow holes.

In conclusion, we submit that the location of the test ingot in the heat with respect to the regular ingots cast is also deserving of consideration, as is also the precise method of making the analysis for the various chemical elements; but as these matters must of necessity require much time and study, we feel that they can be best left to development by the American Society for Testing Materials. The above mentioned recommendations, we feel, are more pertinent to present conditions and warrant early consideration.

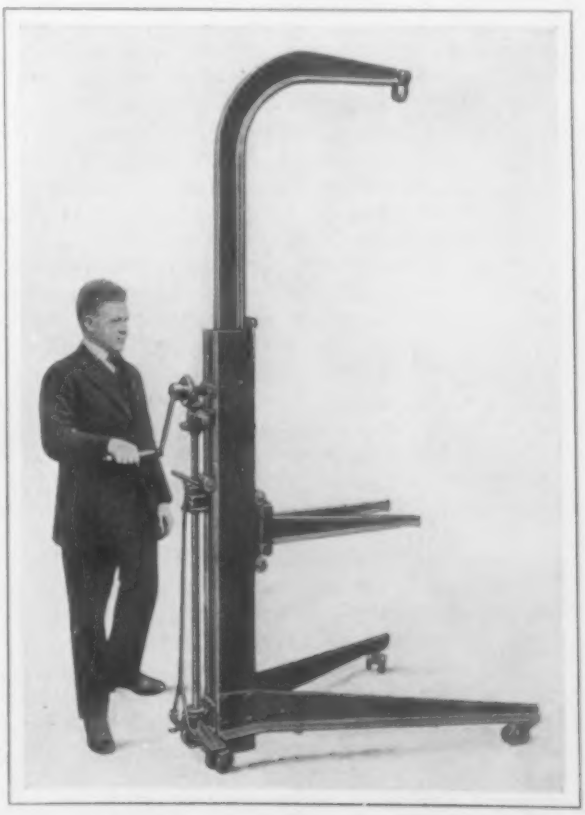
The Pennsylvania Railroad Company will make extensive improvements to its docks at Erie, Pa. It will install a new ore-handling plant, a contract for which has been placed with the Mead-Morrison Mfg. Company, Boston, Mass. Receipts of Lake Superior iron ore at Erie have largely increased this year, the most of this going to Eastern furnaces.

A Portable Crane Without Any Chains

The Zinke Company, Inc., 1322 Michigan Avenue, Chicago, Ill., has placed on the market a portable crane, having no chains, the load being raised by the boom, or arms. The arms may be swung clear of the load if they are in the way when the boom is in use.

A vertical screw operates the boom or the lifting arms and the use of a fine threaded screw enables the load to be raised or lowered to a fraction of an inch while it is emphasized there is no danger of slipping. Two rates of speed are available, the change from one to the other being made by shifting the handle from the position shown to the lower shaft at the side of the crane.

If desired the load may be raised by fastening it to the ring at the end of the boom and hoisted 35 in., the boom in its highest position being 111 in. from the floor. If desired the crane with the lifting arms in their lowest position may be run under the load which is hoisted by the operation of



A Portable Crane in Which Chains Have Been Eliminated and the Load Is Raised by a Screw Actuated Boom

the vertical screw. The capacity of the crane is 4000 lb. and it is pointed out that the use of ball and roller bearings throughout enable one man to raise this easily.

A Summer Course in Scientific Management

Two Weeks' Experience Strengthens a Belief in Teachableness of Subject—Industrial Engineering as a Profession Promises Many Opportunities

BY WILLIAM KENT*

I HAVE been to school again. I have attended a two weeks' course in industrial organization and scientific management given at State College, Pa., Aug. 14 to 28, by Prof. Hugo Diemer, head of the department of industrial engineering, assisted by William H. Tabor, formerly of the Tabor Mfg. Company, Philadelphia, in charge of shop management.

I received a circular announcing that a summer course was to be given, the number of students being limited to twenty, and the announcement was so attractive that I could not resist the temptation to go to school again, although over sixty years of age, in order to get some of the latest ideas on scientific management, to learn whether or not it could be taught in a school, how it is taught, and finally to form some ideas as to how it should be taught in the future.

WILLIAM KENT

"I could not resist the temptation to go to school again, although over sixty years of age."

The question whether scientific management can be taught in a school has been settled in the affirmative by the three years' experience of State College. No amount of negative argument to the effect that scientific management cannot be taught in a school and that the only place to learn it is in a shop can offset the actual facts demonstrated by experience.

The class numbered only eleven students, the ages ranging from about twenty-five years to over sixty and averaging about forty years. Men came from places as widely separated as Connecticut, North Carolina and Illinois, and their occupations and professions were similarly varied. They included a certified public accountant, the treasurer of a manufacturing company, a shop superintendent, a superintendent of construction and repairs of a large factory and his assistant, an expert in concrete construction, a salesman, a purchasing agent, a consulting engineer and a merchant tailor. One profession was conspicuous by its absence, that of teacher in an engineering school. Next year, it is to be hoped that several members of this profession will attend the course.

AN OUTLINE OF THE COURSE

Following is an outline of the course. On the first day Professor Diemer gave us a talk on the general principles of scientific management and business organization and handed us mimeograph copies of lists of the several branches of these two general subjects that might be studied, with references of books and magazine articles in which they are treated. The number of branches was entirely too great for them all to be covered in the two weeks' course, and the members of the class were asked to vote by ballot on the subjects which they individually preferred to be given the greatest prominence in the course. As a result of the vote, it appeared that cost accounting was the favorite subject, factory organization and planning and routing came next in order. Therefore, for the first three days of the class, the morning sessions were devoted to bookkeeping, cost accounting, distribution of burden and similar topics.

The whole course involved strenuous work on the part of both students and instructors. In the morning three and a half hours were given to class room work, including lectures, blackboard instruction and debates. A fifteen minute recess was given in the middle of the session. The afternoons were spent in the shops, watching and making lists of different operations that were performed by the machinist in charge, making actual time studies with the use of stop watches, and in the drafting room making instruction cards and route sheets. Methods of keeping and accounting for stores were also demonstrated in the shop.

The evenings were devoted generally to writing up notes and reading the forty or fifty books on business organization, cost accounting, scientific management, etc., which were provided in the club room of the engineering college. Lectures and talks were also given by four of the students, the subjects being wealth, scientific management in a paper box factory, accounting system in a bridge works, and a demonstration of the use of blood pressure apparatus as a means of showing the health of the workman.

CAN AND OUGHT TO BE TAUGHT IN COLLEGE

The method of teaching these subjects used by Professor Diemer was a combination of talks from previously prepared notes, questions asked by the students, and debates, some of which, especially those relating to labor questions, were quite vigorous. The sessions resembled those of a section of an engineering society discussing a single topic in which all the members of the section are interested. There was one notable difference between a class room session of a summer course like this and a session of an ordinary class in college. College men have been divided into two classes. Those which come, and those who are sent, and of the latter class many are listless and indifferent and act as if they wished to get as little education as possible for the expenditure of their time and their parents' money. In the summer course, the students are those who come and they are intensely interested in getting as much education for their time and money as possible.

In this particular course, each student expressed himself, at the close, as being more than satisfied with what he had received. It was a liberal education in general principles, with just enough insight into details to give a full appreciation of the fact that a vast amount more is to be learned before the student can consider himself as being at all expert in any single branch of the subject. In time study, for example, all the students were

*Consulting engineer and author of Kent's Mechanical Engineers' Pocketbook.

"duffers." The recording of the time of motions to the nearest hundreth of a minute was beyond their capacity from lack of experience, and on comparing notes it was found that the "personal equation" was exceedingly erratic. We learned enough about cost systems to appreciate the fact that most of them are bad and that a really good one is something for the future to bring forth.

WILL RANK WITH OTHER ENGINEERING WORK

As a result of the writer's experience in the summer course, he is firmly of the opinion that scientific management and industrial engineering generally can be taught in a college, that it ought to be taught in a college, preceded or supplemented, as may be most convenient, by some years of actual shop experience, that it will be taught in engineering colleges in the future and will be given the same rank as civil, mining, mechanical and electrical engineering branches now have.

As already has been said, it is greatly to be regretted that several college professors did not attend this summer session. In fact it would be well if some college deans and trustees could be induced to attend such a course. They would have their eyes opened as to the enormous future of business engineering as a profession. Forty years ago, there were doubts in the minds of a number of people as to the possibility of teaching mechanical engineering in a college. In the year 1871, Stevens Institute of Technology was opened as a school of mechanical engineering. Six years afterward, it graduated only ten students, but since that date the number of mechanical engineering colleges and mechanical engineering departments in universities has grown immensely and the number of graduates runs into thousands every year.

There are far more mechanical engineering graduates than can possibly find employment as mechanical engineers in the accepted sense of the term, that is, engineering relating to the design and construction and operation of machines. Most of the graduates drift into employment in commercial business in which they rapidly forget all that they have known about calculus, thermodynamics, descriptive geometry and kinematics, or have occasion to make use of their little knowledge of a foreign language. It is high time for engineering colleges to consider whether they should not establish courses in industrial engineering to which students could be admitted without passing examinations in higher mathematics, languages, or in those special subjects which have application only in the arts of design and construction. The opportunities available for graduates of a course in industrial engineering should be as great as, if not greater than those of civil, mining, mechanical or electrical engineering.

While the establishment of courses in industrial engineering in universities and engineering colleges is highly desirable, it is not to be understood that they can be established without abundant facilities and careful research into the best methods of establishing them and as to the best curriculum to be adopted. The ideal course would be one in which the shop facilities, including forging, pattern and machine shops, are provided at least as extensive as those of State College in which actual commercial operations can be carried on, turning out a salable product, and one in which the instructors shall have had some years of practical experience in the Taylor system of scientific management. The subject is well worth the attention not only of engineering educators but also of some one or more millionaires who are desirous of founding an engineering institution which will ultimately prove of the greatest good to the greatest number of engineers.

Finally, it is to be hoped that the summer course to be held at State College next year will have forty students, and that among them will be some scientific managers of the Taylor group who are preparing to teach, and of engineering teachers who are preparing to introduce scientific management into their courses.

Plating Aluminum with Nickel

An apparently successful method of plating aluminum with nickel was described in a recent number of the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, by J. Canac and E. Tassilly. The process permits the direct deposition of nickel on aluminum in an adherent form. The metal is cleaned by passing it through a bath of boiling potash and then scrubbed with milk of lime. After soaking in a bath of 0.2 per cent potassium cyanide for several minutes, it is submitted to the action of an iron-hydrochloric acid bath, 500 parts, HCl, 500 parts H_2O and one part iron, until the metal takes on a certain appearance described as metallic "watering." It is washed with water after each of these operations.

The formula found satisfactory for nickel plating is: Water, 1000 cu.c.; nickel chloride, 50 grams; boric acid, 20 grams. The current is 1 amp. at 2½ volts. The plated metal is said to have a pleasing soft gray appearance, easily taking a metallic luster when polished with a wire brush, the plating being remarkably adherent. The plated metal is claimed to endure hammering and to be bent in sheet form without cracking. The metal, as cleaned in the iron-acid bath, shows under the microscope a surface full of minute cavities in which the nickel deposits and adheres.

Louisville Night Manual Training School

Such success has attended the night manual training school established by the Board of Education of Louisville, Ky., that a waiting list has had to be established. This applies especially to the machine shop. The object of the school, which was started last year, is to enable employees of manufacturing plants to improve both their practical and theoretical knowledge and prepare for advancement. The subjects taught are woodworking, machine-shop and forging practice, pattern making, mechanical drawing, electricity, chemistry and shop arithmetic. The total number of students enrolled is 280. Manufacturers are much pleased with developments in this connection, and are encouraging their men to enter the school. It is open four nights a week.

The Interstate Commerce Commission recently held a hearing at Chattanooga, Tenn., for the purpose of hearing the complaint of local manufacturers on an increase in pig-iron rates from Ironaton and Shelby, Ala., to Chattanooga, from 75c. to $1.15 per ton.

"The Development of Armor-Piercing Shells" is the title of a 25-page pamphlet published by the author, Carlos de Zafra, faculty lecturer at New York University. The pamphlet touches on the modern type of gun and the manufacture of projectiles, and discusses the author's patented improvement on armor-piercing shells. A copy of the pamphlet can doubtless he had on application to the author, who may be reached at 322 West Fifty-seventh Street, New York City.

In three days last week five ore vessels from Cuba arrived and were unloaded at the dock of the Maryland Steel Company, Sparrows Point, Md., setting a new record. The total amounted to 29,500 tons. Part was reshipped to the Steelton plant of the Pennsylvania Steel Company.

A deposit of manganese ore showing nearly 52 per cent manganese is reported discovered in South Australia about 76 miles from Port Augusta. The indications point to a large quantity.

ESTABLISHED 1855

THE IRON AGE

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Serious Freight Situation

Shippers of iron and steel for export are facing embarrassments. In an editorial in THE IRON AGE of Nov. 18 attention was drawn to the impeding of the export movement by the lack of ships to move freight from docks at Atlantic seaports, especially New York. This situation, instead of improving, has become aggravated. The past week the Delaware, Lackawanna & Western Railroad declared an embargo on all eastbound freight intended for export. This embargo went into effect at midnight Nov. 27, applying to all shipments except the comparatively small quantities for which space had already been contracted for by shippers on Atlantic liners. It is stated that this is the first embargo on freight ever declared on the Lackawanna Railroad. The statement is also made that fully 6000 freight cars on this road, which is many times the normal traffic, are en route from Buffalo, but hundreds of them are at a standstill on sidings. It was therefore considered wise by the management to declare a halt on eastbound shipments before the railroad had become so completely blocked that even local business could not be handled.

On Monday of this week the Baltimore & Ohio Railroad declared an embargo on iron and steel for export through New York on account of the congested condition of its terminal. The Pennsylvania Railroad at the same time put an embargo on all flour and lumber for export at New York, and also shut off grain destined for export at Philadelphia and Baltimore.

A meeting was held in New York on Wednesday, Nov. 24, at which all the trunk lines were represented, for the purpose of endeavoring to arrive at some means of overcoming the congestion of freight for export. It was agreed at this meeting to reduce the free storage time on export freight not consigned on through bills of lading from thirty days to fifteen days, effective from Jan. 1, but it was considered doubtful whether a regulation of this kind would afford sufficient remedy.

If this condition should continue it will probably be merely a question of time as to when it will have an unfavorable effect on the operations of steel works now turning out so large a part of their product for export. If the freight movement by rail to the seaboard is impeded or completely checked the operations of the mills will be seriously interfered with. It is to be hoped that ship owners may be able to divert vessels to this trade from other routes so as to improve the export movement. In that direction appears to lie the only possibility of early relief.

When Will Steel Calm Down?

The wildly excited market that has obtained in the steel trade in the past few weeks has not been such as to suggest directly that a quieter condition is to follow and yet it must be recognized that such conditions cannot continue indefinitely. The very intensity of the storm brings the end the sooner.

The steel mills have pursued a course calculated to quiet the steel market eventually, as they have advanced prices very sharply, more rapidly indeed than ever before in the history of the industry, and in many lines they have discontinued entirely the practice of making open contracts for specification later, confining their business to specific orders. When the physical condition is that they cannot make deliveries on new business except many months in the future and the mental attitude is that they will accept specific orders only, the booking of new business must naturally stop.

The rise has left the industry with some great irregularities to smooth out. There will be deliveries in January and February of steel sold at present prices and also of steel specified in the present quarter against contracts made in the first half of the year, the deliveries representing divergences in invoice prices as great as from $6 to $10 a ton in many cases. The buyer of the higher priced material as well as the buyer of the lower priced will be glad to get the steel, no doubt, but when the case arises of making fresh purchases buyers will have different mental attitudes.

Whatever fluctuations may occur in steel prices in the next few months the market will have its great test when the mills are prepared to enter really important tonnages upon their books, and that will not be for several months to come. Then there will be the consumptive demand pitted against the productive capacity, a plain tryout in accordance with the law of trade. To what extent high prices will tend to discourage consumption cannot be gaged. The conditions are altogether exceptional, and indeed if they had not been steel prices would not have advanced so rapidly in the past few weeks. The general level of commodity values may be such, and the prospects of earnings upon new investments so

bright, that buyers may not hesitate to pay relatively high prices for steel. An illuminating test will probably occur in the structural trade, the quietest of all the steel-consuming trades in the past year. As orders for steel for large fabricated structures must be placed well in advance of the construction period, the market prospects should disclose themselves in the near future. The export trade may be expected to make a clearer showing in the next few months, export sales being almost at a standstill at present, owing to the mills being in no position to figure intelligently upon deliveries. If the attitude of domestic consumers to high prices cannot be forecasted with any degree of assurance, certainly it is idle to speculate upon whether buyers in neutral countries will take hold freely. In the case of war material it is naturally more a question of what is needed or can be used rather than a question of what it will cost, and in that quarter time also must be allowed to tell its tale.

That excitement in the iron and steel trades in general has not become a thing of the past is obvious from the behavior of the pig-iron and scrap markets in the past few weeks. They have taken on a new facility in price movements. On a general average pig-iron prices have advanced in the past month more than one-half as much as they did in the four months preceding, while in the first half of the year they did not advance at all, although steel prices were moving up consistently in a manner satisfactory to the tastes of the steel trade at that time. The Pittsburgh scrap market has just had a sensational rise, and Pittsburgh scrap dealers are seeking scrap in places quite out of the way, places more than a thousand miles distant in some instances. So much attention has been focused upon "the scarcity of steel" in the past three months that pig iron and scrap have appeared plentiful in comparison, but the latest developments suggest that they, too, may become scarce, and if they do the chapter relating to steel scarcity and steel price advances is not closed. Left to itself the steel market might possibly calm down, particularly as a holiday lull is always in order, but if much excitement develops in the related markets it can hardly do so when it is in such a sensitive position as at present.

Co-operation Among Associations

Too many associations there may or may not be in trade and industry, but it is certain that too many of them overlap in their activities. Usually a given association begins with a well-defined object, but after inoculation with the idea that a membership increase is all important, it ends in taking to itself the burdens of industry and society, with the result that several organizations try to shoulder the same load.

Within each society there is a group of men who have worked for it and who are jealous of its prestige and of the things it has done and hopes yet to do. These members are prone to encourage the consideration by their society of subjects which while reasonably within its scope in the broadest terms are after all properly in line with the primary objects of some other organization. The result is more or less competition for contributions to maintain the high degree of activity at which the managers naturally aim. Duplication of effort follows. The man who signs checks for dues is convinced that there are too many associations. And the man who has not the bank account to allow him to sign many such checks may find that the organization of his own specialty is not the sole medium for the exchange of opinions and experience in his line, nor the most likely means of furthering a movement in which he has a vital interest.

A suggested way out of the situation is the institution of committees made up of representatives of different associations having certain common interests. In connection with the National Founders' Association and other employers' organizations the idea has worked out with marked success. Economy of effort has been secured through the conference board, as it has been termed, of duly accredited delegates from the different associations. These have considered, for example, the safeguards and sanitary measures needed in factories.

The steam boiler code fathered by the American Society of Mechanical Engineers is another case in point. At the outset, what had already been done by a number of associations on the same subject was either unknown or disregarded, and all the associations interested had to be brought together before the atmosphere was cleared. The standard established for pipe flanges and fittings is also the work of a few associations—of manufacturers, users and designers—but even so there are signs of jealousy because some one association seems to be getting the major credit. Recent co-operation between the American Society for Testing Materials and the American Foundrymen's Association is encouraging.

The successes that have resulted to date from co-operative association work indicate that above all a specific object is necessary—not the meeting of an academic need but a practical and necessary end. It seems clear also that such a union of interest should not be continued after its particular object has been achieved.

High Prices and Orders

The extraordinary character of the times in the steel market has been brought home to manufacturers and consumers in many ways. No more striking proof could be had that all standards are being ignored than this statement in the *New York Times* concerning some Pittsburgh comment on the Pennsylvania Railroad's withdrawal of its car inquiry:

> The railroad found the prices too high and the deliveries proposed unsatisfactory, and withdrew all inquiries. In plain words, the railroad refused to be held up by the manufacturers; it refused to compete with shrapnel buyers in the buying of steel products. A curious turn was reported from Pittsburgh in this piece of business. The Pittsburgh steel masters, it was reported, were elated because the railroad had withdrawn its orders. They were relieved because the making of 9000 [11,000] steel cars would have put them under a great strain. They took the view that this business would come to them anyway after a while, and if the price of steel was lower later it would be all the more satisfactory for their big customer. An order a year hence, they figured, might also serve to keep their shops busy when shrapnel and shell orders began to fall off. There were apparently no hard feel-

ings over the failure to get together in a simple business proposition.

Being pleased that 11,000 cars have been lost for an indefinite time because of high prices, these particular steel masters, it may be assumed, will be more pleased if all the 35,000 cars now under inquiry are withdrawn from the market. And if the disappearance of business is pleasing because later it will come back when prices drop, by the same token it would be gratifying to steel manufacturers to have a good share of the orders now on their books canceled and to have building projects that are now expected to be put through laid aside indefinitely. It is characteristic of all booms to have the opinion obtain widely at some stage in the uprush that prices have reached a level which will be maintained indefinitely and from which they can only with great difficulty recede. But the day always comes—and most unexpectedly to those who were certain that it was far off—when orders drop off, investors wait and what were called "firm" contracts become inactive through lack of specifications and finally are treated as though they were not.

With the ascent still vigorously in progress and likely to continue, the various phases of the movement after the top has been reached are not particularly timely, but it is not amiss to point out that it is rather early in the day for congratulations over the naming of prices that kill off business, unless there is more certainty than there has been in any similar upward movement heretofore that there is no duplication of consumers' requirements in what is already on the books.

The formation of the American International Corporation with a capital of $50,000,000 and leading New York financiers at its head is an event whose far-reaching influence can scarcely be overestimated. The financing of two South American government loans in the past year represents so far most of what this country has done in this phase of foreign trade promotion in the commodities of peace. What is now ahead is such participation in industrial and public utility operations abroad as will mean the permanent linking up of American capital with the development of outside countries. Naturally Russia will be the greatest field for the activities of the new company and others like it, for while it is the pioneer under the new conditions it will not long be alone in this movement. The United States is entering upon a period of foreign trade expansion in which problems will be met greater in some respects than any with which American business men have grappled. It is not surprising that at such a time captains of industry and finance cry out for a Congressional leader like the late Marcus A. Hanna and for the kind of Cabinet his type of American business man would pick for such a campaign as ought now to be well along in the planning.

The American Tool Works Company, Cincinnati, Ohio, is rushing preparations for the construction of a modern manufacturing plant, 256 ft. front and 260 ft. deep, four stories and basement, to contain approximately 238,000 sq. ft. The construction will be reinforced concrete. The site corners on Pearl, Eggleston, Third and Boston streets.

The Proposed Eastern Blast Furnace Consolidation

As was stated by THE IRON AGE in referring to the options given recently to New York and other capitalists on the properties of the Thomas Iron Company, Easton, Pa., and the Wharton Steel Company, Wharton, N. J., options were sought by the same interests on the Empire Steel & Iron Company's blast furnaces in the Lehigh Valley and in New Jersey and on its New Jersey iron mines. This latter option was given last week, the price being understood to be $4,000,000. The Empire Steel & Iron Company has $1,254,770 of common stock and $2,500,000 of preferred stock, so that the price named would represent something over par for the combined issues. The company's furnaces are at Oxford, N. J., and at Topton and Macungie, Pa., and it owns all the capital stock of the Crane Iron Works which has two furnaces at Catasauqua, Pa. It has the Mt. Hope and Oxford, N. J., iron mines, the Mt. Hope Mineral Railroad and the Victoria Coal & Coke Company, which has a coal mine at Caperton, W. Va., with capacity of 120,000 tons a year and 135 coke ovens with capacity of 35,000 tons a year.

The New York banking house which is carrying on the negotiations for the Eastern blast furnace consolidation now has options on properties representing a total purchase price of more than $8,000,000. The Thomas Iron Company option, as already stated, is on a basis of $55 a share for 50,000 shares. The Wharton properties, into which $3,000,000 was put in blast furnaces alone, are under option on a $1,500,000 basis, a large part of the proposed consideration being in bonds on the properties themselves, which include in addition to two large and well equipped blast furnaces and one small one, the Hibernia iron mine. It is understood that in the case of none of the three companies was any price paid for the options which have been given. It is expected that there will be definite developments in the new project within the present month and it is considered probable that options will be exercised on at least two of the companies under consideration.

Charles M. Schwab on Steel Outlook

Charles M. Schwab, chairman of the Bethlehem Steel Company, South Bethlehem, Pa., was the guest of honor at a luncheon given by the Chamber of Commerce in Pittsburgh on Wednesday, Nov. 24, at which he made an address. In an interview Mr. Schwab said that in his opinion this country is in for a long period of prosperity. In 1900 he predicted that by 1920 our annual steel production would reach 40,000,000 tons, and Mr. Schwab believes that his forecast made fifteen years ago will be more than realized. He also stated that he had not sold one share of Bethlehem Steel Company stock, and that no merger of that company with any other is contemplated, specifically naming in this connection the Cambria Steel Company. In his address Mr. Schwab said in part:

"The United States will soon lead the other nations of the world, both financially and industrially. It is up to the Government to make it possible to send our products to foreign countries. It is not right that our legislators should hesitate to pass the necessary laws, fearing that a certain class of people may be benefited. This great industrial center should be the first in the United States to do all it can to persuade and prod the Government to pass laws so that American ships will soon dot the oceans. I will soon be the largest importer of iron ore from foreign countries. It has been necessary for me to arrange with foreign ships to bring this ore to our shores. It is not gratifying to me that these cargoes will not come here in American bottoms.

"I wish to advise my friends to go with caution into untried fields. I am prompted to say this because of

the temptation of manufacturers to take contracts for certain products in which the profits give promise of being large.

"To my mind, we are in a period of prosperity that will last as long as the recent period of depression through which this country has gone, if not longer."

MORE GOVERNMENT WORK

Navy Department Will Give Less and Less to Private Establishments

WASHINGTON, D. C., Nov. 30, 1915.—Plans are being rapidly pushed by the Secretary of the Navy not only to build battleships Nos. 43 and 44 in Government yards because of the failure of private shipbuilders to keep their bids for these vessels within the limit fixed by Congress, but also to bring about the equipment of as many navy yards as Congress can be induced to provide for so that the bulk of each year's naval program, including vessels of all sizes, may be constructed by the Government. In addition, Secretary Daniels is urging upon incoming Senators and Representatives the importance of providing a large appropriation for an armor plant to enable the Navy Department to manufacture all the armor plate that may be needed in connection with the so-called program of preparedness now under consideration. The Secretary is also seeking an appropriation for a projectile factory capable of turning out the bulk of the shells required by the Navy up to the big 14-in. armor-piercing projectiles.

Secretary Daniels has ordered the old steel foundry at the New York Navy Yard reopened for the ostensible purpose of obviating delays in delivery of castings by private contractors. This foundry is obsolete and was abandoned several years ago because the department found it much more satisfactory to procure castings from private contractors.

Bids will be opened on Friday, Dec. 3, for 27,600 gross tons of plates, shapes, rivets and castings required for battleships Nos. 43 and 44, and the officials of the Navy Department express great confidence that there will be sufficient competition among the steel producers not only to insure reasonable prices but prompt deliveries when the material is needed.

The Navy Department is preparing to spend more than a million dollars in fitting up five or six navy yards to construct warships if Congress will grant the money. A detailed investigation is now being made by the department to ascertain not only what is necessary to put these yards in shape to build vessels, but also what adjuncts can be provided to render the yards as independent as possible of private manufacturers. If Congress will give the money the Navy Department stands ready to install steel and brass foundries at the principal yards, and consideration is also being given to the enlargement of the department's project for an armor plate factory, so as to provide a Government steel-works capable of producing plates, shapes, etc., for the largest dreadnoughts.

Numerous professional agitators in and about Congress are now seeking to take advantage of the present situation to boom the projects with which they have become identified. Representative Tavenner of Illinois, who represents the Rock Island district in which the big arsenal is located, is out in a demand that the army and fortifications bills shall provide specifically for the manufacture of all war material needed by the Government in Federal establishments. Mr. Tavenner was one of the leading figures in the movement in the last Congress which resulted in the incorporation in the Army and Navy Appropriation bills of a provision prohibiting the use of the Taylor or other systems of scientific shop management in Government establishments. He is now involved in a controversy with the so-called Navy League over charges recently made by him that that organization has been chiefly financed by parties interested in the manufacture of munitions. He has secured the influential backing of Representative Kitchin of North Carolina, the House majority leader, who is advocating an investigation of the Navy League and the National Security League "to ascertain whether the backers of these organizations own stock in munition plants."

W. L. C.

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Brier Hill Steel Company Extensions

W. A. Thomas, president Brier Hill Steel Company, Youngstown, Ohio, states that the two new 90-ton open-hearth furnaces being built by his company will be ready for operation about March 1, 1916, and that they will increase the output of open-hearth steel about 10,000 tons per month. The company has decided to erect 75 by-product coke ovens, and has selected the location for them, but the contract has not yet been placed. More finishing mills are also likely to be added, but definite plans for these have not been made. When the new open-hearth furnaces are in operation, the company will use all the pig iron it makes in its Tod and Grace furnaces, with the exception of about 4000 tons per month, which is needed to supply customers who buy washed metal, the Brier Hill Steel Company being the only concern in this country that makes this product. Mr. Thomas further states that its blast furnaces, open-hearth steel works and sheet mills are all operating to 100 per cent of capacity.

NO RECORD OF SHOP TIME

Government Works to Be Run for Employees—More Eight-Hour Leverage

WASHINGTON, D. C., Nov. 30, 1915.—Suggestions of an extraordinary character for the extension of existing legislation respecting scientific shop management and the eight-hour workday are contained in the forthcoming annual report of the Solicitor of the Navy Department. The peculiar relation of the Solicitor, who is the personal legal adviser of the Secretary of the Navy, gives these suggestions, which amount to recommendations, much importance and all manufacturers having relations with the Government will consult their own interests in closely following developments.

Readers of THE IRON AGE will recall that a provision was incorporated in the naval appropriation act of March 3, 1915, forbidding any person

> having charge of the work of any employee of the United States Government to make or cause to be made with a stop watch or other time-measuring device a time study of any job of any such employee between the starting and completion thereof, or of the movements of any such employee while engaged upon such work, or the payment of any premium or bonus or cash reward to any employee in addition to his regular wages, except for suggestions resulting in improvements or economy in the operation of any Government plant.

It now appears that in certain of the navy yards the employees have taken the position that this provision prohibits any form of supervision which involves keeping a record of the individual performance of each workman. It might have been expected that these contentions would have been sharply disputed by the department and that in the interest of the public service the Government would have been vigorously defended against such demands. The Solicitor, however, apparently deprecates the fact that the prohibition of scientific management was set forth in language so plain that it cannot be held to justify the abolition of all forms of supervision and foreshadows an appeal to Congress to expand the provision so as to satisfy fully the disgruntled employees. He says:

> Inasmuch as the department's decisions were, and must always be, only an interpretation of the law as it stands rather than what it might wish the law should be, and as its decisions in the cases referred to were adverse to the contentions of the employees, it is reasonable to expect that effort will be made at the next session of the Congress to have the law amended so that it may have a wider scope and cover such methods of recording time and performance as have been the subject of complaint.

The average employer will wonder how Congress can legislate further in this direction without turning the entire management of the navy yards over to the employees, but it will not do to assume that the pro-labor contingent in Congress, prompted by the men who have eliminated scientific management from the army and navy establishments, will be unable to invent new methods of tying the Government's hands while hundreds of millions of dollars of the taxpayers' money is being spent.

EXTENSION OF EIGHT-HOUR LAW

The Solicitor's report also makes it clear that during the past year material progress has been made in developing a new policy in enforcement of the eight-hour law. The expansion of the old law by the act of June 19, 1912, so that it extended to the plants of contractors doing Government work was at the time regarded by Government officials as most disadvantageous to the Navy Department, in that it materially reduced the number of concerns competing for contracts and increased the cost of all material manufactured on a strictly observed eight-hour day. The attitude of the present administration of the department toward this costly innovation is quite different, as will be gathered from the following extract from the report:

> Evidences have multiplied in the last year of the advance and the increase in public favor of the eight-hour-workday idea, and the labor organizations have received great encouragement and moral support from the application of the eight-hour law of June 19, 1912, which has been found by them to be a powerful leverage for obtaining better hours and better conditions throughout the country. As was not unnatural in applying a law so far-reaching in its effect as the one mentioned above, the department, in pursuance of its understanding of interpretations of the act by previous attorneys general, held in several cases where there was ample room for doubt, that the eight-hour restriction of the act did not apply to many articles that were manufactured according to the department's specifications, and in many cases received complaints from labor organizations against what seemed to them to be an unwarrantedly liberal interpretation of the law against the application of the eight-hour-day rule. Such condition arose in connection with the construction of the machinery for some of the submarine boats which was built by a subcontractor at a different yard from that where the boats themselves were building; but this particular question has now been settled in accordance with what seems to be a more appropriate and accurate interpretation of the law and an interpretation upon which both the labor organizations and the department freely and fully unite. This revised interpretation of the law is based upon an opinion by Attorney General Gregory, addressed by him to the Secretary of War under date of May 12, 1915, relating to the contract for furnishing the marble for the Lincoln Memorial.

The Attorney General's decision referred to applies the restrictions to sub-contractors under conditions which his predecessors had regarded as outside the field covered by the provisions of the act of 1912. That the present administration of the Navy Department does not intend that there shall be any further "unwarrantedly liberal interpretation of the law" in favor of the Government and the taxpayers is clearly indicated by the solicitor. He says:

> There have also been many other cases in which articles once considered exempt from the eight-hour restriction have, under said opinion of the Attorney General, been reclassed among the articles to which such restriction is applicable, and it is a subject for congratulation to the department that these questions could be settled to the advantage of the persons in whose interests the law was passed and that it has been able to take the leading part in so important a matter as aiding to spread a custom that is beneficial to so large a part of the citizenry of the country, the effects of which, owing in large measure, no doubt, to the department's administration of the law, now appear to be more far reaching in advantageous results than it is believed they were originally expected to be.

It might be interesting to inquire whether the taxpayers or the immediate beneficiaries of the act of 1912 constitute the greater part of the "citizenry of the country," but apparently the Navy Department is not viewing this important subject from a particularly wide angle. It is even quite oblivious of the fact that one of the "advantageous results" of the new policy is a material increase in the cost of everything purchased by the private shipyards for use in the construction of war vessels, that constitutes an important factor in the situation regarding the contracts for battleships Nos. 43 and 44, concerning which Secretary Daniels appears to be so much excited.

W. L. C.

The stockholders of the Cleveland-Cliffs Iron Company, Cleveland, Ohio, have received notice that the company contemplates the authorization of $3,500,000 collateral trust 6 per cent bonds to reduce the floating debt and to make permanent provision for future requirements. Of the total $1,050,000 will be issued at this time and offered to shareholders at par and interest. These bonds will mature Nov. 1, 1917, to May 1, 1920. The company's balance sheet as of Sept. 30, 1915, shows $18,581,197 in property and $11,294,437 in investments. The outstanding stock was $4,910,000; bonds, $249,000; notes, $2,001,236; other liabilities, $2,657,194, and surplus, $20,058,204.

E. M. Colquhoun of Philadelphia, formerly with the United Gas Improvement Company, has purchased an interest in the Wincroft Stove Works, Middletown, Pa., and has become vice-president and general manager of the company. He succeeds Charles S. Prizer and has already taken charge of the plant. Mr. Colquhoun announces that there will be no other changes in the officers or policy of the company.

Operating Costs of the Heavy Oil Engine

Symposium of Engineering Papers Which Discussed the Field—Operating Costs, and Fuels Available for the Diesel and Other Oil Engines

The heavy oil engine, which includes the Diesel engine, formed the subject of several papers presented in San Francisco in September at the meetings of the American Society of Mechanical Engineers and of the International Engineering Congress.

A. H. Goldingham, of the De La Vergne Machine Company, New York, writing on the present status and future development of the heavy oil engine for the mechanical engineers, said:

Since the oil engine was invented about 1870, rapid progress has been made with it. . . . The thermal efficiency of 12.8 per cent in 1888 has, through improvement in design and by increased compression in the later engines, been increased to 30.5 per cent in the hot-surface type of oil engine, and to 32.5 per cent in the Diesel engine on the basis of brake, or actual horsepower.

APPLICATIONS OF THE DIESEL ENGINE

The field of the Diesel engine was outlined in the paper, "The Diesel Engine and Its Application in Southern California," by Walter Holbrook Adams, professor of mechanical engineering, Throop College, Pasadena, Cal., as follows:

The Diesel engine is in use to-day in almost all places where a steam engine or turbine might be used. Its starting torque is poor and it should run at a constant speed, although this may be varied to some extent. The rated load decreases as the altitude at which the engine operates is increased. It gives excellent service when installed as a pumping engine. It can be used for all kinds of factory service just as well as the steam engine. The reasons why it is not adopted more extensively in this country are probably:

1. The availability of cheap fuel has prevented a demand for an expensive first cost prime mover that will give decreased operating cost.
2. American manufacturers have been slow to take up the manufacture and introduction of these engines.
3. Engines giving satisfactory service have only been made in Europe within the last five years.
4. A Diesel engine requires extreme care in manufacture and in adjustment, particularly of the fuel valve.
5. The engine cannot be operated without careful supervision when the cleaning and adjusting are going on.
6. Some prejudice exists against all forms of internal combustion engines due to the multiplicity of causes that may prevent their starting.
7. Oil must be used as fuel, and the cost may vary within wide limits.
8. Innate conservativeness of the human race makes it slow to adopt a new method of machine until others have tried it.

EFFICIENCY AND ECONOMY

The efficiency and economy of the Diesel engine is claimed to be the best of all the present engines, and this may be still further increased by utilizing the heat of the exhaust to make steam for running a steam turbine.

The economy of oil engines is shown by Mr. Goldingham in the two accompanying tables. Table I shows the power costs of a mining plant in New Mexico, which operates continuously 24 hr. per day. The equipment consists of two 180-bhp., one 250--bhp., and one 280-bhp. hot-surface type engines belted to shafting or direct connected to generators. They operate on fuel oil of 22 deg. Baumé. Due to the distance of the plant from a railroad and its altitude (7000 ft.) the fuel oil costs 16.5 cents per gallon. A comparison of the cost of fuel for operation, based on oil at 2 1/7 cents per gallon is made in the table, to enable the costs to be reduced to ordinary operating conditions:

Table I—Power Generation Costs (1914) of Mining Plant Operating Four Oil Engines

Estimated Output		Oil Consumed				Cost of Operation, Dollars							Total Cost, Dollars
				Lb. per		Labor		Materials and Supplies					
At Switchboard, Kw.-Hr.	At Engines Hp.-Hr.	Gal.	Lb.	Kw.-Hr. Switchboard	Hp.-Hr. Engines	Operating	Maintenance	Fuel Oil 16½c. Gal.	Lubricating Oil 71c. per 1000 Hp.-Hr.	Repair Parts	Belts	Misc. Supplies	
2,469,293	3,996,196	278,595	2,061,602	0.84	0.52	7907.31	2211.76	46,603.02	2838.82	1659.50	792.92	1044.64	63058.57
Per kw.-hr.	.....	0.113	0.835	.....	.....	0.0032	0.0009	0.0188	0.0011	0.0007	0.0008	.....	0.0255
Per hp.-hr.	.....	0.083	0.516	.....	.....	0.0020	0.0006	0.0116	0.0007	0.0004	0.0005	.....	0.0158
								Fuel Oil 2 1-7c. Gal.	Lubricating Oil 35c per 1000 Hp.-Hr.				
.....	.....	.....	.....	.....	.....	.....	.....	5969.29	1400.00	.....	.....	.....	20985.42
Per kw.-hr.	.....	.....	.....	.....	.....	.....	.....	0.0024	0.00057	.....	.....	.....	0.0086
Per hp.-hr.	.....	.....	.....	.....	.....	.....	.....	0.0015	0.00035	.....	.....	.....	0.0053

Based on 8640 hr. per year, that is with fuel at 16.5c. per gallon and lubricating oil at 71c. per 1000 hp.-hr. equivalent to: $136.51 per hp. year at the engines: $164.41 per kw. year at the switchboard.

Or with fuel oil at 2 1/7c. per gallon and lubricant at 35c. per 1000 hp. hours equivalent to: $45.70 per hp. year at the engines: $74.50 per kw. year at the switchboard.

The last-named figures are given showing costs under ordinary conditions. Allowance must be made for increased cost of materials and supplies due to excessive charge for transportation.

OPERATION AND DEPRECIATION

Concerning the reliability of oil engines in operation, Professor Adams says, regarding the Diesel engine:

The Diesel engine will work nearer to test conditions at all times than any other type of prime mover, as it is more independent of the operator and requires a good compression for ignition. The efficiency depends upon the compression; if this latter drops due to valve trouble the engine will show it at once, as there will not be heat enough to ignite the fuel. . . . . One engineer can handle 1000 to 1500 hp. per shift. The attendance consists in keeping the engine supplied with both fuel and lubricating oil and the minor work that there always is around a power plant. Operators and manufacturers say that it is necessary to examine the fuel valve and the exhaust valves periodically and clean them. The time in-

terval for this depends upon the kind of fuel in use—it may be a week or several months.

The question of maintenance and depreciation is still an open one. The maintenance charges per year seem to average about one per cent of the first cost of the engine. Few manufacturers have yet had engines in service for any length of time, so that the life of the engine is still uncertain. The Busch-Sulzer Diesel Engine Co. has two 225 b.h.p. engines installed in Texas which were put in over nine years ago; these have been operating on an average of 18 hr. a day. The cylinders have never been rebored and now show very little wear and are as smooth and bright as glass. The same company also has a 225 b.h.p. engine in Illinois which has been working for 24 hr. a day, 6¾ days a week, for over 2½ years, with only two minor shut-downs. The following facts seem to be fairly well established: 1. The Diesel engine can operate continuously for 6½ or more days out of seven. 2. This can be kept up for long periods if a short interval is allowed for overhauling and minor repairs. 3. The exhaust valves may give trouble by burning if the load is too large. 4. The air compressor may give more trouble than the engine if it is not watched. 5. Dirt in the oil will give trouble. 6. Water in the oil will give trouble. 7. The engine will not carry much more than its rated load for any length of time.

Mr. Goldingham presents further information on the subject of reliability by means of table III, which shows the performance of the four hot-surface type engines whose operating costs were given in table I.

Table III—Operation of Four Oil Engines During 1914

Engine No.	Desired Period of Operation, Hr.	Actual Period of Operation, Hr.	Per Cent of Desired Period
1	6803.80	6684.54	98.25
2 (spare unit)	.....	700.47	.....
3	8556.75	8411.55	98.30
4	8626	8457.47	98.05

Table II shows the costs of installing and operating different types and sizes of engines in California under varying conditions. The table was compiled in 1914, and the prices given for the various fuels may not now be correct:

Table II—Cost of Oil Engine Operation in California (1914)

Size of Unit	Type of Engine	B.h.p. per Gal. Fuel	Fuel Cost per Gal., Cents	First Cost per b.h.p., Dollars	Total First Cost, Dollars	Yearly Fixed 20 per Cent Charge, Dollars	Fuel Cost 24 Hr. per Day for 100 Days, Dollars	150 Days, Dollars	200 Days, Dollars	250 Days, Dollars	Total Yearly Charge, Fuel Plus Fixed Charges 100 Days, Dollars	150 Days, Dollars	200 Days, Dollars	250 Days, Dollars
50 hp.	Distillates	10	5	25	1250	250	600	900	1200	1500	850	1150	1450	1750
	Tops distillates	10	2½	25	1250	250	330	495	660	825	580	745	910	1075
	Semi-Diesel	10	2 1-7	60	3000	600	257	385	514	624	857	985	1114	1242
	Diesel	16	2 1-7	75	3750	750	160	241	321	401	910	991	1071	1151
100 hp.	Distillate	10	5	30	3000	600	1200	1800	2400	3000	1800	2400	3000	3600
	Tops	10	2½	30	3000	600	660	990	1320	1650	1260	1590	1920	2250
	Semi-Diesel	10	2 1-7	55	5500	1100	514	770	1028	1284	1614	1870	2128	2384
	Hot surface-high economy	16	2 1-7	65	6500	1300	320	482	642	802	1620	1782	1942	2142
	Diesel	16	2 1-7	75	7500	1500	320	482	642	802	1820	1982	2142	2302
150 hp.	Distillate	10	5	30	4500	900	1800	2700	3600	4500	2700	3600	4500	5400
	Tops	10	2½	30	4500	900	990	1485	1980	2475	1890	2385	2880	3375
	Semi-Diesel	10	2 1-7	50	7500	1500	771	1155	1542	1926	2271	2655	3042	3426
	Hot surface-high economy	16	2 1-7	65	9750	1950	480	723	962	1203	2430	2673	2912	3153
	Diesel	16	2 1-7	70	10500	2100	480	723	962	1203	2580	2823	3062	3303
250 hp.	Distillate	10	5	30	7500	1500	3000	4500	6000	7500	4500	6000	7500	9000
	Tops	10	2½	30	7500	1500	1650	2475	3300	4125	3150	3975	4800	5625
	Semi-Diesel	10	2 1-7	50	12500	2500	1285	1925	2570	3210	3785	4425	5070	5710
	Hot surface-high economy	16	2 1-7	60	15000	3000	800	1202	1605	2005	3800	4202	4605	5005
	Diesel	16	2 1-7	65	16250	3250	800	1202	1605	2005	4050	4452	4854	5255

The yearly fixed charge is arrived at as follows: Interest, 6 per cent; taxes and insurance, 1 per cent; repairs, 3 per cent; depreciation, 10 per cent.

Engine using distillate 48-51 deg. B. oil has a thermal efficiency of 20 per cent under full load; engine using tops distillate 38-42 deg. B. oil has a thermal efficiency of 20 per cent under full load; semi-Diesel engine using 24-28 deg. B. oil has a thermal efficiency of 18 per cent under full load; hot surface high economy engine using 16 deg. B. oil has a thermal efficiency of 27 per cent under full load; Diesel engine using 18 deg. B. oil has a thermal efficiency of 28.4 per cent under full load.

FUELS

Concerning the fuels available for the Diesel engine, Professor Adams writes as follows:

Any fuel that will burn without leaving an ash or residue, either due to incomplete combustion or due to unburnable material in the fuel, may be used in a Diesel engine. Attempts have been made to introduce pulverized coal into the cylinder of the engine, but these have not as yet been successful. Gasoline, kerosene and the light distillates need not be considered as fuel for the Diesel engine as they can be used to better advantage elsewhere. There is left crude oil, low-grade distillates and the coal tar products. The last has not been used to any great extent in this country.

Crude oil which is free from sand and water can be used as fuel, even if it contains as much as 50 per cent asphaltum. Owing to the scarcity of gasoline, to-day practically all crude oil has the gasoline content removed before it is sold for fuel, so that all fuel oil is "topped" oil.

A viscous and sluggish oil can be heated by the cooling water as it leaves the engine, or by the hot exhaust gases, until it becomes fluid. It can be pumped as well as any oil. When such an oil is employed kerosene should be used to start up and for a few minutes before shutting down, so as to clean all the heavy oil from the piping and pumps.

The high sulphur content oil is more dangerous, as it burns to sulphur dioxide, which tends to cause corrosion of the piston and cylinder, the valves and valve seats and the exhaust pipe. The maximum amount of sulphur that can be allowed seems to be about 2 to 4 per cent.

Water in the oil will decrease the heating value and cut down the amount of fuel delivered to the cylinder. If the water comes in "slugs" it will cause the engine to run irregularly. "Topped" oil will not contain much water, as it will be removed during the topping process. Most manufacturers specify an oil containing less than 1 to 2 per cent of water.

The ash is of considerable importance as it tends to remain in the cylinder, causing cutting of the walls, the valves and the valve seats. This makes the maintenance charges high. The Eastern paraffine base oils can be cleaned much easier than the Western asphaltum base oils. In the latter the asphalt collects around the sand particles, and it is impossible to separate them except by heating the oil and straining it while hot.

Dealing with the same subject, Max Rotter, chief engineer of the Busch-Sulzer Bros. Diesel Engine Company, St. Louis, in a paper before the International Engineering Congress, contributes this information:

Although almost all forms of carbonaceous and and hydrocarbon fuels, from powdered coal to gas, have been tried experimentally in Diesel engines, commercially successful operation has been confined to liquid fuels—more particularly to mineral oils and coal tar. In the United States the relative value of tar is so high, on account of the marketable products obtainable from it and its use for roofing and similar pur-

poses, that there has been no inducement to use it for Diesel engine fuel, in preference to the cheap petroleum fuels.

There does not appear to be any limitation to the possibility of using mineral oils in Diesel engines, from the heaviest crudes to refined kerosene; but commercial and practical considerations tend to give preference to fuel oils ranging between 24 deg. and 36 deg. Baumé. The available supply of these fuels is large in proportion to the demand for them, so that they may generally be purchased at prices as low as, or lower than those of crudes, from which the valuable lighter and heavier constituents have not been abstracted. The heat value of petroleum oils is rarely lower than 19,000 B.t.u. per

pound, high value. Based upon weight, the heat value decreases as the gravity becomes heavier; but based upon volume, the reverse is the case, although to a less degree. For instance: a 15-deg. crude of 17,900 B.t.u. per pound has a heat value of 144,000 B.t.u. per U. S. gallon; while a 39-deg. distillate or fuel oil of 19,500 B.t.u. per pound, or 9 per cent higher, on a weight basis, has a heat value of 135,000 B.t.u. per U. S. gallon, or 6 per cent lower, on a volume basis.

Fuel oils, for use in Diesel engines, should contain the lowest proportions of the following impurities compatible with the prices demanded:

Water:—Because it is charged for at the fuel oil price; it reduces the efficiency of the engine; it increases the maintenance costs; and it has a detrimental effect upon the regulation. More than one-third of 1 per cent of water should be considered excessive; and, if fuel containing more than this has been accepted, the water should be settled out, by heating the oil with a steam coil.

Sulphur:—If in excess of 1½ per cent, the combination of the sulphurous fumes with the vapors of the water of combustion, will corrode and pit the exhaust valves and seats, and rapidly eat out the exhaust piping.

Ash:—A comparatively minute percentage of entirely non-combustible matter in the fuel causes an accumulation on the oily cylinder walls, between these and the piston, which will result in excessive wear.

Asphaltum:—This much abused term is susceptible to so many and various interpretations, that it has no definite significance. Nor has the method for its determination been standardized. The various chemical and mechanical (penetration) determinations have little or no bearing upon the complete combustibility in a Diesel cylinder under the conditions existing in it and within the available time. A comparison of results obtained in actual use for the above purpose, with oils containing a substance, other than ash, which will not volatilize under certain definite conditions, appears to be the best guide as to the proportion of this substance which will render necessary an excessively frequent cleaning of the cylinder and its adjuncts. Several years of careful observations and records have induced the oldest Diesel engine builders in this country to adopt, for such comparisons, the percentage of residue remaining after the sample of oil has been gradually brought to a temperature of 300 deg. C. and then subjected to this temperature for 120 hr. in a closed furnace, in which combustion does not take place. Under this treatment the sample is reduced to practically constant weight. It has been determined that, so long as this residue is less than 10 per cent of the original weight of the sample, unreasonably frequent cleaning is not necessary. This percentage is equivalent to anywhere from 7 to 30 per cent of "Asphaltum," according to the various methods of determination in use. If the fuel oil contains more than the above-mentioned 10 per cent of residue, its use must be guided by the relative cost of the oil, and the cost and inconvenience of labor and stoppages required for the more frequent cleaning. The form of the atomizer does not appear to have any bearing upon this question, as the substance does not become objectionable until after the fuel has entered the cylinder and its more volatile constituents have become gasified; although it may render the fuel so "heavy" that warming is necessary to enable the oil to flow to and be handled by the fuel pump of the engine.

In conclusion, may be given table IV, compiled by Mr. Goldingham, comparing the physical and chemical characteristics of the more commonly available engine fuels:

Recent Progress in Pyrometry

Since 1910 no pyrometers based on new principles have been introduced, it is pointed out by C. R. Darling in a general review of the progress of pyrometry in the *Journal of the Royal Society of Arts*. The advances made have been confined to improvements in methods previously in use. The values now generally recognized for purposes of standardization are:

Water, boiling point, 100 deg. C.; aniline, boiling point, 184 deg.; naphthaline, boiling point, 218 deg.; tin, melting point, 232 deg.; cadmium, melting point, 321 deg.; lead, melting point, 327 deg.; zinc, melting point, 419 deg.; sulphur, boiling point, 445 deg.; antimony, melting point, 631 deg.; sodium chloride, melting point, 800 deg.; silver, melting point in reducing atmosphere, 961 deg.; gold, melting point, 1063 deg.; copper, melting point, graphite covered, 1083 deg.; lithium metasilicate, melting point, 1202 deg.; nickel, melting point, 1450 deg.; palladium, melting point, 1550 deg.; platinum, melting point, 1755 deg.; tungsten, melting point, about 3000 deg.; carbon arc, about 3500 deg. C.

For thermoelectric pyrometers base metals have been used to a considerable extent for the construction of thermocouples. This has been so not only because of the comparative cheapness of such materials but the fact that properly chosen base-metal couples develop a relatively high electromotive force. Kowalke has shown that base-metal couples are liable to alter if subjected to continued heating, and suggests that such couples should be "aged" by continued heating before calibration. Carbon and graphite couples have been used for temperatures exceeding 1200 deg. C. (Bidwell, *Phys. Rev.*, June, 1914). The potentiometer principle has been largely adopted for commercial instruments.

Few changes have been introduced in resistance pyrometers. Sir William Crookes has shown recently that platinum is measurably volatile at 1000 deg. C., and this explains why pyrometers give erroneous readings when continuously used for higher temperatures.

A Substitute for Magnesite Brick

A uniform and intimate mixture of granules of basic slag and dolomitic lime, about 10 to 90 parts, respectively, is recommended by Albert P. Meyer as a substitute for magnesite brick, now so scarce, as a lining for furnaces of certain types. The suggestion is covered by a patent (U. S. 1,160,085) assigned to the A. S. Davison Company, Pittsburgh, Pa. A hard, compact, dense variety of dolomitic limestone is recommended, preferably high in magnesia, which should be bruned until sintered or semi-fused, similar to cement-clinker making, but with a higher finishing temperature, around 2800 deg. Fahr. The crude sintered granules of this lime are then mixed with granulated basic slag.

Ferrovanadium exports for September were 43,692 lb., making the total to Oct. 1, this year, 648,863 lb. against 602,850 lb. and 478,335 lb. for the same periods in 1914 and 1913 respectively.

Table IV—Comparison of Engine Fuels

Maker	Union Oil Co.	Union Oil Co.	Std. Oil Co.	Std. Oil Co.	Union Oil Co.	General Petroleum Co. National Petroleum Co.		
Trade Name	California Crude	Diesel Oil	Calol Fuel Oil	Star Fuel Oil	Stove Oil	Kellogs Stove Dist. Hvy. Slush Tops	Kellogs No. 2 Tops Dist.	No. 1 Water White Dist.
Gravity at 60 deg. in deg. Baumé	14–18	23.5–24	24	27.2	28	36–40	43–45	48–51
Flashpoint (Abel-Pentsky) burning pt. closed cup, deg. Fahr.	150–175	175–185	150	190	175	100	50	25–30
	175–225	.....	.....	225	210	125	65–75	40–50
Flashpoint open cup burning pt., deg. Fahr	.....	195–205	.....	210	200	120	62	30–35
	.....	235–245	.....	243	225	140	72	50–60
B.t.u. per lb.	18,500	18,950–19,250	19,000	19,200	19,300	18,000–19,000	18,000–19,000	18,000–19,000
Sulphur, per cent	Usually under 1	0.75	0.75	0.02	0.02	0.02	0.02	0.02
Asphalt, per cent	50	20	25	20	10–20	0.10	0.05	0.091
Water, per cent	Usually under 2	0.5	.....	0.08	Trace	Trace	None	None
Residue	.....	.....	.....	At 300 deg. fahr. 3 per cent	.....	.....	At 500 deg. fahr. less than 1 per cent	.....

NEW WAYS TO RAISE REVENUE

Increase in Income Tax Likely—The Proposal to Levy on Munitions

WASHINGTON, D. C., Nov. 30, 1915.—The plans for the consideration of the revenue problem at the coming session of Congress, as practically decided upon, indicate that there will be no precipitate action in the imposition of an internal revenue tax on war munitions, although it is now certain that there will be a strong movement in Congress to tax all forms of war material intended for export. Senators and Representatives who have arrived in Washington are being flooded with suggestions for this tax and with protests against it. They reply that the matter will probably not be taken up until after the holiday recess.

As Congress meets on Dec. 6 and will probably adjourn for the holiday recess about Dec. 21, and as the emergency war revenue act, which is to be extended for another year, expires by limitation on Dec. 31, the leaders have decided that the only chance of re-enacting the law before its expiration will be to rush through both houses a simple resolution providing for the extension without amendment or modification of any kind. In the Senate this will not be easy. The proposal to adopt a cloture amendment to Senate rules will be stoutly opposed by the minority, and the contest may provoke so much partisan feeling as to make it well nigh impossible to secure Republican support for any feature of the Administration's program that might be brought forward.

OBJECTIONS TO MUNITIONS TAX

Secretary McAdoo in a public statement recently submitted suggestions for increasing the revenues. He was careful not to mention a tax on war munitions, as the Internal Revenue Bureau has not yet completed the survey recently ordered of the industry engaged in the production of war material. He enumerated an increase in the rates of taxation on individual and corporate incomes, a reduction in the exemption under the present law of $3,000 for single and $4,000 for married persons to $2,000 and $3,000 respectively, the taking effect of the surtax at $10,000 or $15,000 instead of $20,000 as at present, a tax on gasoline and crude and refined oils and on automobiles and other internal combustion engines, "and various other articles not necessary to mention."

The basket clause in the Secretary's list of revenue projects, it will be noted, is quite ample to include war munitions if the Internal Revenue Bureau reports that this is practicable and desirable. Reports from collectors indicate that it will not be feasible to impose a direct tax on war material. It is very difficult to define "war material" beyond controversy, and in the second place no method has been suggested for imposing a tax on munitions intended for exportation that would not be open to the objection that the Federal Constitution prohibits the imposition of an export tax, either direct or indirect. It has been proposed that the law prescribe a tax on all war materials with a proviso that if made for the United States Government they shall be exempt, but as this would mean the taxing only of munitions intended for exportation, it is feared the courts would hold the provision to be unconstitutional. Senator Walsh of Montana, a leading member of the Senate Committee on the Judiciary, has given notice of his intention to make a careful study of the constitutional aspects of a tax on the production or exportation of war munitions, in the hope of devising some legal method of imposing such a charge.

Senator Meyers, Senator Walsh's colleague, is understood to be at work upon a bill taxing war material producers 50 per cent of their profits. He has taken this figure from measures now before the British Parliament and the German Federal Council taxing munitions manufacturers one-half the profits made by them during the war and in excess of the normal profits of previous years.

The proposition to tax gasoline, crude and refined oils, automobiles and other internal combustion engines is likely to arouse opposition in a very influential quarter, namely, among the farmers in all sections of the country. When the emergency revenue act was originally framed by the Ways and Means Committee in October, 1914, a provision was inserted taxing gasoline, but the small farmers' protests were so potent that the Senate Finance Committee cut it out.

Among the more thoughtful of the Congressional leaders the tendency in the extension of tax measures will be toward levies on net incomes and such luxuries as can be taxed in the hands of the consumer or user. One measure already drafted by an experienced member of the House proposes an inheritance tax, a reduction in the income tax exemptions, a lowering of the incidence of the surtax from $20,000 to $10,000 incomes, an increase in the tax rate on incomes above $15,000, and a tax on the ownership of automobiles based on retail selling price. It hardly need be said that any tax imposed on gasoline or any other form of fuel would have to be paid by the consumer, notwithstanding the intent of Congress to impose it on the producer.

W. L. C.

New Can Company in Cincinnati

The Cincinnati Can Company, incorporated in Ohio by interests identified with the Edwards Mfg. Company, will add another large industry to Cincinnati. While it is primarily a consolidation of several small companies whose plants were in other cities, their united operations will be expanded. The principal company taken over was the Eureka Specialty Company, having a plant at Ludlow, Ky., and another at Greenfield, Ohio. The new company, which is capitalized at $100,000, will manufacture a line of sheet metal specialties, including oil cans, ice cream freezers and miscellaneous articles. It will occupy the factory buildings at Carthage Pike and the Big Four Railroad, Cincinnati, formerly used by the Cellular Metal Company. This property belongs to the Edwards interests. New additions will be made to the plant and a force of 200 men will soon be employed, and salesmen will be needed.

The incorporators are E. W. Edwards, president of the Edwards Mfg. Company, who will be president of the new company; H. W. Edwards, who will be vice-president; O. S. Larkby, who will be secretary; G. D. Myers, who will be treasurer; J. C. Miller, who will be superintendent of the plant; H. A. Greening, who will be sales manager, and G. R. Edwards, Morgan Wamsley and Daniel McLaren.

Donora Open-Hearth Additions

The United States Steel Corporation's subsidiaries are still planning important extensions. Among those in the Pittsburgh district which were included in recent appropriations by the Finance Committee are three open hearth furnaces and a 1000-ton mixer at the Donora plant of the American Steel & Wire Company. The report that a blast furnace will be added at the Donora works is not confirmed.

Don F. Kennedy, manufacturers' agent, 1257 David Whitney Building, Detroit, Mich., has arranged to take over the sales in the western part of the country of the Hammond Steel & Forging Company, Syracuse, N. Y., manufacturer of hammered tool steel bars, die blocks and special forgings, effective Dec. 1. The present office of the company in the Dime Bank Building, Detroit, will be discontinued. Mr. Kennedy also handles the accounts of the T. R. Almond Mfg. Company and the Sawyer Tool Mfg. Company, Ashburnham, Mass.

Zirconium-iron alloys can be easily made by the reduction of the oxides of the two metals, according to a patent (U. S. 1,151,160) granted to Edward R. Cooper, Baltimore, Md. The reduction may be brought about by aluminum or by carbon in an electrically heated crucible, the reaction being more easily carried on in the presence of a little titanium oxide which is also reduced, the titanium giving valuable qualities to the alloy, it is claimed.

EFFECTS OF BLOOMING ON RAILS*

Manipulation of Bloom and Rapidity of Reduction Without Marked Influence

BY M. H. WICKHORST

An investigation was made concerning the influence on the rails, of the manner in which the bloom is rolled, particularly with reference to the transverse ductility of the bottom of the base of the rail. Blooms were rolled from ingots with varying amounts of reduction between turns. Some ingots were given light reductions or squeezes and turned so as to bring the other two sides in contact with the rolls, and other ingots were given successively greater reductions between turns. Also some of the rails were rolled so that what was the top side of the ingot as it first entered the blooming rolls formed the head of the rail and other rails were rolled so that the top side of the ingot formed the web of the rail. The work was done at Ensley, Ala., at the works of the Tennessee Coal, Iron and Railroad Company, which furnished all the material and facilities for the investigation. The rails were made by the open-hearth process and were tested by means of drop tests, tension tests, transverse tests of the base, and polishing of cross-sections.

METHOD OF MANIPULATION

Sixteen ingots were selected for special blooming. Eight were rolled "top in top," that is, with the top side of the ingot as it first entered the blooming rolls, rolled into the head of the rail, and the other eight were rolled "top in web," that is, with the top side of the ingot rolled into the web of the rail. The amounts of reduction between turning were varied in the early part of the blooming and were, respectively, 1 in., 2 in., 3 in., 4 in., 6 in., 8 in., 10 in., and regular practice, two ingots being rolled for each of the eight rolling conditions. From the standpoint of the construction of the mill, it was considered not advisable to reduce the ingot more than 2 in. in one pass, and the reductions, between turning, of 3 in. or more were therefore produced in two or more passes.

In the drop test the rails rolled "top in top" gave about the same results as those rolled "top in web." With the head in tension the ductility in the drop test was about the same for the different rates of reduction. With the base in tension there was a general decrease in ductility as the rate of initial reduction in blooming increased, but there was considerable irregularity in the results and it would take a much more extensive set of tests to be able to state this as a law.

Transverse tests of the base were made by placing the rail on two supports, 6 in. long, placed opposite each other near the edges of the flanges, and applying the load to the head of the rail at the middle. The general average results showing breaking load and transverse ductility of the rails rolled "top in top" were about the same as those of the rails rolled "top in web." The transverse results were also about the same for the various rates of reduction in blooming.

DUCTILITY AN IMPORTANT CONSIDERATION

The longitudinal ductility of the base in the drop test avraged 15.6 per cent and the transverse ductility of the base in the transverse test averaged 2.7 per cent. It is suggested that part of the problem of improvement of rails consists of increasing the transverse ductility of the base and particularly of eliminating the cases of very low transverse ductility.

In the tensile tests the rails rolled "top in top" gave about the same results as those rolled "top in web." The tensile results were also about the same for the various rates of reduction. Incidentally to the main theme of the investigation, a comparison was made of the tensile results from three locations in the rail section, namely, the upper corner of the head, the interior of the head and the flange. For a given tensile strength the ductility was greatest in the flange, next in the corner of the head and least in the interior of the head. Cross-sections were cut from the head of the rails, polished with emery, etched with copper-ammonium chloride solution and finally polished with tripoli. No internal cracks were found in any of the samples examined.

In conclusion, the general results may be summarized as follows: The rails rolled "top in top" gave about the same results as those rolled "top in web," in the drop tests, transverse tests of the base and tensile tests. The results were also about the same for the various rates of reduction in making the bloom, except that in the drop tests with the base in tension there was a general decrease in ductility as the rate of initial reduction increased, but there was considerable irregularity in the results and it would take a much more extensive set of tests to be able to state this as a law. This work had reference particularly to the transverse ductility of the base, and not specially to the production of seams due to the tearing open of the sides of the bloom in rolling.

*Summary of report of engineer of tests to Rail Committee, American Railway Engineering Association, June, 1915.

Railroad Car Business

Quiet buying of railroad cars seems still to be the order of the day. For some time inquiries for a definite number have finally developed into orders for two or three times that number, and now it is believed that some cases of recent hesitation to buy will result in purchases, prices on open bidding having been obtained. It is held by car builders that no better prices will be secured by the railroads in this way. The car purchases of the week include the following: 1000 ore cars for the Duluth, Missabe & Northern to the Western Car & Foundry Company and 200 hopper cars for the same road to the Pullman Company; 250 ore cars for the Duluth & Iron Range to the American Car & Foundry Company. Incidentally it is expected that the United States Steel Corporation mine roads have yet to place 750 cars. The Interborough has placed 311 passenger cars with the Pullman Company, together with a considerable number of trucks, and the Cambria Steel Company will furnish the axles. The St. Louis Car Company is to build 150 cars for the Pittsburgh Railways. The Pressed Steel Car Company has taken 100 ore cars for the Utah Copper Company.

The Grand Trunk is in the market for repairs to 1500 steel cars; the Delaware & Hudson for 1000 underframes and the Denver & Rio Grande for 1000 box cars.

Locomotive Orders

Orders for locomotives in the past week aggregate 45, the largest of which is 27 for the Elgin, Joliet & Eastern, to be built by the American Locomotive Company. The Baldwin Locomotive Works will construct six for the Duluth & Iron Range. It is estimated that 345 locomotives have been ordered in November up to the 27th, making a total of 1849 for the year to that date. In the first half the total was 936, of which 371 were domestic.

Large Exports of Billets to England

The United States continues to export large amounts of steel billets and blooms to England. In October Great Britain imported from this country 23,412 gross tons against 1022 tons in October, 1914. To Nov. 1, the total is 312,642 tons, as compared with 23,369 tons to Nov. 1, 1914.

The Yeomans Brothers Company, 231 Institute Place, Chicago, announces that it has taken charge of the sale and installation, throughout the United States and Canada, of the Shone pneumatic sewage ejectors manufactured by the Shone Company, Chicago, in addition to its own centrifugal ejectors, bilge pumps and other lines of pumping machinery.

The next convention of the American Iron, Steel and Heavy Hardware Association will be held in the new William Penn Hotel, Pittsburgh, May 24, 25 and 26, 1916, as decided on at the recent semi-annual meeting of the executive committee in New York.

The Iron and Metal Markets

FOR SECOND HALF OF 1916

Sales Made at Much Higher Prices

Mills Far from Meeting Demand—Eastern Ore Buying for Next Year

The pressure from manufacturing consumers for protection on contracts they have taken has led producers to book considerable finished material in the past week for the third and fourth quarters of 1916. The higher prices asked did not deter the buyers, plates and shapes for cars being sold at 1.85c., Pittsburgh, as against 1.70c. on first half contracts.

New export business has been checked by the action of leading producers in refusing offers from abroad of several dollars a ton above domestic prices, also by the railroad embargo and the stringency in the ocean freight situation. In one case 60,000 tons of plates, shapes and bars were refused though 2.10c., Pittsburgh, was offered. But with all the increased concentration of steel works on domestic demand, there is no measurable gain in their ability to cope with it.

At Chicago, where up to two months ago the situation was much easier than at Pittsburgh, buyers are now exerting themselves to get on the books of the mills without special regard to prices and often without definite assurance as to deliveries.

Complaints of the failure of mills to deliver on contracts placed months ago are more frequent. On the other hand mills find here and there evidence of overbuying at the low prices. In some of these latter cases the extension of 1915 deliveries into the early months of next year has been arranged and the mills have thus been able to take on occasional orders for early delivery at good profits.

In the buying of shell steel, deliveries reaching to November, 1916, are now being considered in connection with French business, whereas only lately June was the limit. At Cleveland an additional order has been placed for 47,000 tons of steel bars for British shells, to be delivered in 1916.

The advance in prices continues and the difficulties of quoting the market are accented by the inability of many producers, particularly in billets and wire rods, to take on any of the business offered. Billets for export have been sold at $42, Liverpool. For wire rods export offers of $40 to $45 have been made, but domestic consumers cannot compete for the rod supply on that basis.

Among structural steel orders 5000 tons of bridge steel for the Chicago & Northwestern and 5000 tons for its Calumet elevator lead in the list of Western lettings. A Chicago company has also closed two orders for reinforcing bars amounting to 4600 tons.

Plate mills are getting in a stronger position with every week and prices for early delivery are still mounting. At Cleveland as high as 2.25c. has been paid on mill shipments. The Navy Department, in line with the decision to build the two new battleships at Government yards, has called for bids for Dec. 3 on more than 28,000 tons of plates and 5750 tons of shapes and bars.

Store prices continue to advance. At Chicago bars, plates and shapes are up $2 a ton. From Cleveland store the latest advance is $3 on bars and $1 on plates and shapes.

The Missouri Pacific receivers have placed 25,000 tons of rails; the Southern Pacific, 20,000 tons, which will be rolled in Alabama; the M., K. & T. has bought 15,000 tons and the Chicago & Eastern Illinois 10,000 tons from the Illinois Steel Company; the Vandalia, 6000 tons in addition to the recent Pennsylvania Ralroad order, and minor purchases amount to 10,000 tons.

The American Steel & Wire Company has advanced wire products $2 a ton, bringing plain wire up to $1.85 and wire nails up to $2. The discount on field fence has been shortened ½ point.

The situation in basic materials indicates strong confidence on the part of producers and consumers in the continuance of the present scale of demand far into 1916. Pig-iron inquiry is now coming up for the second half of next year. Northern irons have been advanced 50c. and $1 a ton and Southern iron is more generally on a $14 basis, with one large interest holding for $15.

Bessemer iron has gone to $18 at Valley furnace and basic iron to $16.50. Foundry irons are higher on the continuance of buying for the first half of next year and the awakening of more sellers to the fact that their capacity for that period has been nearly sold.

While opening sales of Lake Superior iron ore for 1916 wait, the Eastern ore market furnishes an index to the new price level in sales of 105,000 tons of New Jersey ore, on which deliveries begin with January, at 8½c. a unit. This compares with 7c. a unit early in the year and as low as 6½c. a year ago. On this basis the Lake ore advance would be $1 rather than 75c.

A Comparison of Prices

Advances Over the Previous Week in Heavy Type, Declines in Italics

At date, one week, one month and one year previous

	Dec. 1, 1915.	Nov. 24, 1915.	Nov. 3, 1915.	Dec. 2, 1914.
Pig Iron, Per Gross Ton:				
No. 2 X, Philadelphia...	**$18.25**	$17.75	$16.75	$14.25
No. 2, Valley furnace....	**17.00**	16.00	15.00	12.75
No. 2 Southern, Cin'ti..	**16.90**	16.40	15.90	12.65
No. 2, Birmingham, Ala.	**14.00**	13.50	13.00	9.75
No. 2, furnace, Chicago*	**18.00**	17.50	16.50	13.00
Basic, del'd eastern Pa.	**17.75**	17.50	17.00	13.50
Basic, Valley furnace...	**16.50**	16.00	15.50	12.50
Bessemer, Pittsburgh ..	**18.95**	17.95	16.95	14.70
Malleable Bess., Ch'go*.	**18.00**	17.50	16.50	13.00
Gray forge, Pittsburgh..	**16.95**	16.45	15.20	13.40
L. S. charcoal, Chicago.	**17.75**	17.25	16.75	15.75
Billets, etc., Per Gross Ton:				
Bess. billets, Pittsburgh.	**29.00**	28.00	25.00	19.00
O.-h. billets, Pittsburgh.	**30.00**	29.00	26.00	19.00
O.-h. sheet bars, P'gh...	**30.00**	29.00	27.00	20.00
Forging billets, base, P'gh.	**52.00**	50.00	42.00	24.00
O.-h. billets, Phila.....	**36.00**	35.00	32.00	21.40
Wire rods, Pittsburgh...	38.00	38.00	35.00	25.00
Finished Iron and Steel,				
Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Bess. rails, heavy, at mill	1.25	1.25	1.25	1.25
Iron bars, Philadelphia.	1.859	1.859	1.659	1.12
Iron bars, Pittsburgh...	1.65	1.65	1.50	1.15
Iron bars, Chicago.....	1.60	1.60	1.45	0.90
Steel bars, Pittsburgh..	1.70	1.70	1.50	1.10
Steel bars, New York..	1.869	1.869	1.669	1.26
Tank plates, Pittsburgh.	1.90	1.90	1.50	1.05
Tank plates, New York.	2.169	2.169	1.769	1.26
Beams, etc., Pittsburgh.	1.70	1.70	1.50	1.10
Beams, etc., New York..	1.869	1.869	1.669	1.26
Skelp, grooved steel, P'gh	1.70	1.70	1.45	1.10
Skelp, sheared steel, P'gh	1.80	1.80	1.50	1.15
Steel hoops, Pittsburgh..	**1.90**	1.75	1.75	1.25

*The average switching charge for delivery to foundries in the Chicago district is 50c. per ton.

Sheets, Nails and Wire, Per Lb. to Large Buyers:	Dec. 1, 1915. Cents.	Nov. 24, 1915. Cents.	Nov. 3, 1915. Cents.	Dec. 2, 1914. Cents.
Sheets, black, No. 28, P'gh	**2.50**	2.40	2.15	1.85
Galv. sheets, No. 28, P'gh	**4.75**	4.25	3.60	2.85
Wire nails, Pittsburgh	**2.00**	1.90	1.85	1.55
Cut nails, Pittsburgh	1.85	1.85	1.80	1.60
Fence wire, base, P'gh	**1.85**	1.75	1.70	1.35
Barb wire, galv., P'gh	**2.85**	2.75	2.70	1.95
Old Material, Per Gross Ton:				
Iron rails, Chicago	16.00	16.00	14.25	11.00
Iron rails, Philadelphia	17.50	17.50	17.50	13.00
Carwheels, Chicago	14.50	14.50	12.50	9.50
Carwheels, Philadelphia	**14.50**	14.00	13.50	9.50
Heavy steel scrap, P'gh	**17.25**	17.00	15.00	10.00
Heavy steel scrap, Phila.	**15.00**	14.75	14.50	9.25
Heavy steel scrap, Ch'go	15.00	15.00	12.50	8.25
No. 1 cast, Pittsburgh	**14.50**	14.00	13.50	10.50
No. 1 cast, Philadelphia	**15.00**	14.50	14.00	11.00
No. 1 cast, Ch'go (net ton)	**13.75**	13.00	11.75	8.50
Coke, Connellsville, Per Net Ton at Oven:				
Furnace coke, prompt	$2.10	$2.10	$2.25	$1.50
Furnace coke, future	**2.40**	2.35	2.35	1.75
Foundry coke, prompt	2.75	2.75	2.75	1.90
Foundry coke, future	3.00	3.00	2.60	2.15
Metals,				
Per Lb. to Large Buyers:	Cents.	Cents.	Cents.	Cents.
Lake copper, New York	**20.00**	19.87½	17.87½	13.00
Electrolytic copper, N. Y.	19.87½	19.87½	17.87½	12.75
Spelter, St. Louis	*18.00*	18.75	14.75	5.20
Spelter, New York	*18.25*	19.00	15.00	5.35
Lead, St. Louis	**5.20**	5.17½	4.80	3.67½
Lead, New York	5.25	5.25	4.90	3.80
Tin, New York	**39.50**	39.25	35.87½	33.15
Antimony, Asiatic, N. Y.	**40.00**	39.50	35.50	13.50
Tin plate, 100-lb. box, P'gh	**$3.50**	$3.40	$3.15	$3.15

Finished Iron and Steel f.o.b. Pittsburgh

Freight rates from Pittsburgh in carloads, per 100 lb.: New York, 16.9c.; Philadelphia, 15.9c.; Boston, 18.9c.; Buffalo, 11.6c.; Cleveland, 10.5c.; Cincinnati, 15.8c.; Indianapolis, 17.9c.; Chicago, 18.9c.; St. Louis, 23.6c.; Kansas City, 43.6c.; Omaha, 43.6c.; St. Paul, 32.9c.; Denver, 68.6c.; New Orleans, 30c.; Birmingham, Ala., 45c.; Pacific coast, 73.9c. on plates, structural shapes and sheets and 65c. on wrought pipe and boiler tubes. The foregoing rates to the Pacific coast are by rail. The rate via New York and the Panama Canal is 56.9c.

Plates.—Tank plates, ¼ in. thick, 6¼ in. up to 100 in. wide, 1.70c. to 1.90c., base, net cash, 30 days. Following are stipulations prescribed by manufacturers:

Rectangular plates, tank steel or conforming to manufacturers' standard specifications for structural steel dated Feb. 6, 1903, or equivalent, ¼ in. and over on thinnest edge, 100 in. wide and under, down to but not including 6 in. wide, are base.

Plates up to 72 in. wide, inclusive, ordered 10.2 lb. per sq. ft. are considered ¼-in. plates. Plates over 72 in. wide must be ordered ¼ in. thick on edge or not less than 11 lb. per sq. ft., to take base price. Plates over 72 in. wide ordered less than 11 lb. per sq. ft. down to the weight of 3-16 in. take the price of 3-16 in.

Allowable overweight, whether plates are ordered to gage or weight to be governed by the standard specifications of the Association of American Steel Manufacturers.

Extras	Cents per lb.
Gages under ¼ in. to and including 3-16 in.	.10
Gages under 3-16 in. to and including No. 8	.15
Gages under No. 8 to and including No. 9	.25
Gages under No. 9 to and including No. 10	.30
Gages under No. 10 to and including No. 12	.40
Sketches (including straight taper plates), 3 ft. and over	.10
Complete circles, 3 ft. in diameter and over	.20
Boiler and flange steel	.10
"A. B. M. A." and ordinary firebox steel	.20
Still bottom steel	.30
Marine steel	.40
Locomotive firebox steel	.50
Widths over 100 in. up to 110 in., inclusive	.05
Widths over 110 in. up to 115 in., inclusive	.10
Widths over 115 in. up to 120 in., inclusive	.15
Widths over 120 in. up to 125 in., inclusive	.25
Widths over 125 in. up to 130 in., inclusive	.50
Widths over 130 in.	1.00
Cutting to lengths under 3 ft. to 2 ft., inclusive	.25
Cutting to lengths, under 2 ft. to 1 ft. inclusive	.50
Cutting to lengths under 1 ft.	1.55

No charge for cutting rectangular plates to lengths 3 ft. and over.

Wire Products.—Prices to jobbers: Fence wire, Nos. 0 to 9, per 100 lb., terms sixty days or 2 per cent discount in ten days, carload lots, annealed, $1.85; galvanized, $2.55. Galvanized barb wire and staples, $2.85; painted, $2.15. Wire nails, $2. Galvanized nails, 1 in. and longer, $1.75 advance over base price; shorter than 1 in., $2.25 advance over base price. Woven wire fencing, 68 per cent off list for carloads, 67 off for 1000-rod lots, 66 off for less than 1000-rod lots.

The following table gives the price per 100 lb. to retail merchants on fence wire in less than carloads, with the extras added to the base price:

Plain Wire, per 100 lb.

Nos.	0 to 9	10	11	12&12½	13	14	15	16
Annealed	$1.90	$1.95	$2.00	$2.10	$2.20	$2.30	$2.40	$2.50
Galvanized	2.80	2.85	2.90	2.95	3.00	3.15	3.50	3.60

Wire Rods.—Bessemer, open-hearth and chain rods, $38.

Structural Material.—I-beams, 3 to 15 in.; channels, 3 to 15 in.; angles, 3 to 6 in. on one or both legs, ¼ in. thick and over, and zees 3 in. and over, 1.70c. to 1.90c. Extras on other shapes and sizes are as follows:

	Cents per lb.
I-beams over 15 in.	.10
H-beams over 18 in.	.10
Angles over 6 in., on one or both legs	.10
Angles, 3 in. on one or both legs less than ¼ in. thick, as per steel bar card, Sept. 1, 1909	.70
Tees, structural sizes (except elevator, handrail, car truck and conductor rail)	.05
Channels and tees, under 3 in. wide, as per steel bar card, Sept. 1, 1909	.20 to .80
Deck beams and bulb angles	.30
Handrail tees	.75
Cutting to lengths under 3 ft. to 2 ft. inclusive	.25
Cutting to lengths, under 2 ft. to 1 ft. inclusive	.50
Cutting to lengths, under 1 ft.	1.55

No charge for cutting to lengths 3 ft. and over.

Wrought Pipe.—The following are the jobbers' carload discounts on the Pittsburgh basing card in effect from Aug. 16, 1915, on steel and iron galvanized pipe, and from Nov. 1, 1915, on steel and iron black pipe, all full weight:

Butt Weld

Steel			Iron		
Inches	Black	Galv.	Inches	Black	Galv.
⅛, ¼ and ⅜	71	46½	¼ and ¼	63	37
½	75	59½	⅜	63	37
¾ to 3	78	63½	½	67	47
			¾ to 2½	70	52

Lap Weld

2	75	60½	1½	54	36
2½ to 6	77	62½	1½	65	47
7 to 12	75	58½	2	66	49
13 and 14	61½	..	2½ to 4	68	52
15	59	..	4½ to 6	68	52
			7 to 12	66	50

Reamed and Drifted

1 to 3, butt	76	61½	1 to 1½, butt	68	50
2, lap	73	58½	2, butt	68	50
2½ to 6, lap	75	60½	1¼, lap	52	34
			1½, lap	63	45
			2, lap	64	47
			2½ to 4, lap	66	50

Butt Weld, extra strong, plain ends

⅛, ¼ and ⅜	66	49½	⅜	60	43
½	71	58½	½	65	51
¾ to 1½	75	62½	¾ to 1½	69	53
2 to 3	76	63½	2 and 2½	70	54

Lap Weld, extra strong, plain ends

2	72	57½	1½	64	48
2½ to 4	74	59½	2	66	49
4½ to 6	73	58½	2½ to 4	68	52
7 to 8	67	50½	4½ to 6	67	51
9 to 12	62	45½	7 to 8	60	44
			9 to 12	55	39

Butt Weld, double extra strong, plain ends

½	61	48½	½	55	40
¾ to 1½	64	51½	¾ to 1½	58	43
2 to 2½	66	53½	2 and 2½	60	45

Lap Weld, double extra strong, plain ends

2	62	49½	2	56	40
2½ to 4	64	51½	2½ to 4	58	45
4½ to 6	63	50½	4½ to 6	57	44
7 to 8	57	40½	7 to 8	50	33

To the large jobbing trade an additional 5 per cent is allowed over the above discounts.

The above discounts are subject to the usual variation in weight of 5 per cent. Prices for less than carloads are two (2) points lower basing (higher price) than the above discounts on black and three (3) points on galvanized.

Boiler Tubes.—Discounts on less than carloads, f.o.b. Pittsburgh, freight to destination added, on lap welded steel tubes and standard charcoal iron tubes, effective from Dec. 1, 1915, are as follows:

Lap Welded Steel		*Standard Charcoal Iron*	
1½ in.	47	1½ in.	42 to 43
1¾ and 2 in.	59	1¾ and 2 in.	46 to 47
2¼ in.	56	2¼ in.	43 to 44
2½ and 2¾ in.	62	2½ and 2¾ in.	50 to 51
3 and 3¼ in.	67	3 and 3¼ in.	54 to 55
3½ to 4½ in.	68	3½ to 4½ in.	56 to 57
5 and 6 in.	61	5 and 6 in.	50 to 51
7 to 13 in.	58		

Locomotive and steamship special charcoal grades bring higher prices.

1¾ in., over 18 ft., 10 per cent net extra.

2 in. and larger, over 22 ft., 10 per cent net extra.

Sheets.—Makers' prices for mill shipment on sheets, of U. S. Standard gage, in carload and larger lots, on which jobbers charge the usual advance for small lots from store, are as follows, f.o.b. Pittsburgh, terms thirty days net, or 2 per cent cash discount in ten days from date of invoice:

Blue Annealed Sheets

	Cents per lb.
Nos. 3 to 8	2.20
Nos. 9 to 10	2.25
Nos. 11 and 12	2.30
Nos. 13 and 14	2.35
Nos. 15 and 16	2.45

Box Annealed Sheets, Cold Rolled

	Cents per lb.
Nos. 10 and 11	2.15
No. 12	2.15
Nos. 13 and 14	2.20
Nos. 15 and 16	2.25
Nos. 17 to 21	2.30
Nos. 22 and 24	2.35
Nos. 25 and 26	2.40
No. 27	2.45
No. 28	2.50
No. 29	2.55
No. 30	2.65

Galvanized Sheets of Black Sheet Gage

	Cents per lb.
Nos. 10 and 11	3.75
No. 12	3.85
Nos. 13 and 14	3.85
Nos. 15 and 16	3.95
Nos. 17 to 21	4.10
Nos. 22 and 24	4.30
Nos. 25 and 26	4.45
No. 27	4.60
No. 28	4.75
No. 29	4.90

Pittsburgh

PITTSBURGH, PA., Nov. 30, 1915.

There seems to be no end to the advances in prices. Bessemer pig iron is up about $1 per ton; basic and foundry, 50c.; black and galvanized sheets, $2 to $5; wire rods, about $2; hoops, $3; steel and iron boiler tubes, $2, and nearly all kinds of old material from 50c. to $2 or more. Never before have similar conditions prevailed in the steel trade. Foreign countries must come to the United States for the next two or three years for a large part of their supply of semi-finished and finished steel, and it is claimed that any part of their product that American mills do not sell to domestic users can readily be exported at prices fully as high as those paid by the domestic trade. At the same time we have had examples in this country of the quickness with which the home demand for steel can fall off. A serious shortage in cars developed in this district last week, the two worst days being Thursday and Friday. There is no cessation in the demand for finished steel, and the larger steel companies say they could sell three or four times their output, and at top prices. Customers are complaining bitterly of delayed shipments, in many cases not getting more than 20 to 25 per cent of the amount of material called for in their contracts. On nearly all lines the question of price does not enter, but whether the mill has the material and will sell it.

Pig Iron.—The demand for pig iron is largely for Bessemer and foundry, little having been done the past week on basic. A local interest has made a sale of 3500 tons of Bessemer, deliveries starting in December and running through first quarter, at $18 at furnace, and another sale of 500 tons of Bessemer is reported to a Westinghouse interest at $18.50. In basic, St. Louis and Eastern consumers have inquiries in the local market for 20,000 to 25,000 tons. There have been some fairly heavy sales of No. 2 foundry for delivery in first quarter and first half at $17 and $17.50 at furnace, and some sellers now quote $18. A shortage in supply of Bessemer has developed, the amount available for first and second quarter being very limited. We quote standard Bessemer at $18; basic, $16.50; malleable Bessemer, $16.50 to $16.75; No. 2 foundry, $17 to $17.50, and gray forge, $16, all at Valley furnace, the freight rate for delivery to the Pittsburgh and Cleveland districts being 95c. a ton.

Billets and Sheet Bars.—It is practically impossible to buy open-hearth billets at any price, offers of $30 and more at maker's mill failing to bring out any steel. The shortage in supply of Bessemer is fully as great as in open hearth. New inquiry is fairly heavy. Orders sent to the mills for rolling by the billet and rail sales bureau of the Carnegie Steel Company in November showed an increase of more than 30,000 tons over October. Quoted prices are purely nominal, each transaction depending on the quantity involved and the deliveries wanted. Bessemer and open-hearth billets would easily bring above $30 and forging billets $52 if they could be obtained. A sale of 200 tons of high carbon forging billets was made last week at $53, maker's mill. We quote Bessemer billets at $29; open-hearth billets, $30, and Bessemer and open-hearth sheet bars, $30, at maker's mill, Pittsburgh or Youngstown districts. For prompt delivery $3 to $5 advance over these prices would be paid. We quote forging billets at $52 for sizes up to but not including 10 x 10 in. and for carbons up to 0.25, the regular extras being charged for larger sizes and higher carbons. Forging billets running above 0.25 and up to 0.60 carbon take $1 per ton extra. Axle billets are held at $48 to $50.

Ferroalloys.—On account of the enormous consumption of ferromanganese there is more uneasiness as to the future supply, and English 80 per cent readily brings $100, seaboard. Domestic is held at the same price, and for prompt delivery carload lots are said to have sold at $105 at furnace. Prices on Bessemer ferrosilicon are strong and we quote: For delivery in first quarter, 9 per cent, $23.50; 10 per cent, $24; 11 per cent, $25; 12 per cent, $26; 13 per cent, $27.50; 14 per cent, $29.50; 15 per cent, $31.50; and 16 per cent, $34. For prompt shipment $2 advance on above prices is quoted, and for second quarter delivery, $1 advance. All these prices are f.o.b. at furnace, Jackson, Ohio, New Straitsville, Ohio, or Ashland, Ky., each of these points having a freight rate of $2 per gross ton to Pittsburgh. We quote 50 per cent ferrosilicon for delivery through all of 1916 as follows: Up to 100 tons, $85; over 100 tons and up to 600 tons, $84, and over 600 tons, $83, all per gross ton, delivered in the Pittsburgh district.

Plates.—Reports are that the steel car companies will not reduce the prices quoted recently on the 11,000 cars for the Pennsylvania Railroad, being indifferent whether the order is placed or not. No important orders for steel cars were booked the past week, but some fairly large inquiries are out. The Duluth, Missabe & Northern has asked prices on 1000 ore and 200 hopper cars; Missouri, Kansas & Texas, 2000 steel gondolas; Duluth & Iron Range, 2000 hopper and 800 ore cars, and the Lackawanna 1000 steel gondolas and 1000 box cars. Local car companies say they are filled through first quarter and report great trouble in getting deliveries of plates and carwheels, especially the latter. The nominal price of ¼-in. and heavier sheared plates is 1.70c. for delivery at convenience of the mill, but for fairly prompt shipment 1.90c. to 2c. has been paid. The two leading local plate mills are absolutely sold up to second quarter of next year. There is no trouble in getting premiums of $2 to $4 per ton on prompt plates.

Structural Material.—Local fabricators are filled up for four to six months, and are not actively bidding on new work. The John Eichleay Jr. Company has taken 250 tons of steel for a post office at Charlotte, N. C., and 150 tons for a post office at Tulsa, Okla. Mills are back in deliveries on shapes from four to six weeks. We quote beams and channels up to 15-in. at 1.70c. for shipment at convenience of the mill. Small lots of beams and channels out of warehouse bring 2.25c. and higher.

Carwheels.—The two local makers report they cannot accept any new orders for steel carwheels for delivery before second quarter. We quote 33-in. freight carwheels in lots of 1000 or more at $18; 33-in. tender wheels, $21; 36-in. passenger or tender wheels, $25. These prices are based on a 10-in. diameter hub, 50c. extra being charged for 11-in., all f.o.b. Pittsburgh.

Steel Rails.—The three rail mills of the Carnegie Steel Company at the Edgar Thomson works are filled up on light rails, standard sections and steel rounds for four months or longer. The steel companies are not anxious to sell steel rails at $28, when they can get $30 and higher for Bessemer and open-hearth billets. The new demand for light rails is active, the local interest taking new orders last week for over 5000 tons. An advance in prices of light rails in the near future is very likely. We quote standard section rails of Bes-

semer stock at 1.25c., and of open-hearth stock, 1.34c., f.o.b. Pittsburgh. We quote light rails as follows: 25 to 45-lb. sections, 1.45c.; 16 and 20-lb., 1.50c.; 12 and 14-lb., 1.55c.; 8 and 10-lb., 1.60c., in carload or larger lots, 5c. per 100-lb. advance being charged for less than carload lots.

Tin Plate.—It is reported that two or three of the larger interests have sold nearly all the tin plate for 1916 delivery at $3.50 and $3.60 per base box that they care to sell. The lower price was made to a very few of their largest consumers. Offers of $3.45 are said to have been turned down. Makers state that any surplus output not readily taken by domestic consumers can easily be sold for export and at higher prices than for domestic. Specifications are coming in for every pound called for in 1915 contracts, and this will supply some consumers for the next two or three months. It is believed that the base price of tin plate will soon be advanced, possibly to $3.75 per box. Export inquiry is active. Operations among mills are slowing down, as new demand for prompt shipment is not urgent. We quote 14 x 20 coke plates at $3.50 to $3.60 per base box for delivery over remainder of this year, and $3.60 per base box for delivery over all of 1916. We quote terne plate, 14 x 20, 8-lb. coating, at $3.40 to $3.50 per box, f.o.b. Pittsburgh.

Sheets.—The demand for blue annealed, black and galvanized sheets is abnormally heavy. Nearly all sheet mills are increasing output when bars can be obtained. This week the American Sheet & Tin Plate Company is operating its sheet mills to 89.2 per cent of capacity, and other leading makers are running to 100 per cent when they can get steel to do so. The large consuming trade is pretty well covered through first quarter. The demand for blue annealed sheets from automobile builders is extraordinarily large, several interests reporting they have taken contracts the past week for 15,000 to 20,000 tons. For delivery through first quarter we quote Nos. 9 and 10 blue annealed sheets at 2.25c.; No. 28 Bessemer black, 2.50c., and No. 28 galvanized, 4.75c. No. 30 black plate, tin mill sizes, H. R. & A., is quoted at 2.40c. to 2.50c., and No. 28, 2.35c. to 2.40c. These prices are for carload or larger lots, f.o.b. maker's mill.

Railroad Spikes.—Orders are coming in freely and makers are filled up for three or four months. A local traction company bought 1000 kegs of standard sizes at $2.10 at mill. Prices are very firm. We quote standard spikes, larger than ½ in., at $2.10; from ½ in. to ⅝ in., $2.20, and 5/16 in. and ⅝ in. diameter, $2.35, per 100 lb., f.o.b. at mill.

Skelp.—This material is scarce, as the mills are filled up for some months. We quote grooved steel skelp at 1.70c. to 1.75c.; sheared steel skelp, 1.80c. to 1.85c.; grooved iron skelp, 2.10c. to 2.15c., and sheared iron skelp, 2.20c. to 2.25c., all delivered to consumers' mills in the Pittsburgh district.

Wire Rods.—It is difficult to find rods at any price, local makers having none to sell and are much behind on shipments to regular customers. There would be no trouble in selling rods at $38 to $40 or higher if they could be obtained. Local makers are turning down export inquiries nearly every day, as they cannot make deliveries.

Wire Products.—Local makers say they could do three or four times as much business as they are doing if they had the material to sell. Nearly all makers of barb wire and wire nails are out of the market until April or longer, having orders for every pound they can turn out up to the second quarter. Agents from foreign countries are flooding this market with inquiries for barb wire, but the business is being turned away. The domestic demand is enormously heavy and the mills are swamped with specifications. One local mill received specifications for wire nails in one day that would take more than a week to turn out. All the mills are back in shipments from four to six weeks and many consumers are not getting more than 25 to 30 per cent of the material called for in their contracts. Premiums of $3 to $5 per ton over mill prices are freely offered for wire for prompt shipment. An advance of $2 per ton in wire products has just been made. Prices quoted, for delivery at the convenience of the mills and to regular customers only, are as follows: Wire nails, $2; galvanized nails 1 in. and longer taking an advance over this price of $1.75, and shorter than 1 in., $2.25; plain annealed wire, $1.85; galvanized barb wire and fence staples, $2.85; painted barb wire, $2.15; polished fence staples, $2.15, all f.o.b., Pittsburgh, with freight added to point of delivery; terms sixty days net, less 2 per cent off for cash in ten days. Prices on woven wire fencing are 68 per cent off list for carload lots, 67 per cent for 1000-rod lots, and 66 per cent for small lots, f.o.b., Pittsburgh.

Rivets.—There has been some complaint recently about the high prices of rivets, but makers say another advance is imperative on account of the high prices ruling for steel bars and the difficulty in getting them. Domestic and export demand is very heavy, and makers are back in deliveries four to six weeks or longer. We quote buttonhead structural rivets, ½ in. and larger, at $2.40, and conehead boiler rivets at $2.50 per 100 lb. in carloads lots, f.o.b., Pittsburgh, smaller lots bringing the usual advances.

Hoops and Bands.—Makers have advanced prices of hoops $3 per ton, or to 1.90c., Pittsburgh. The consuming trade is largely covered for some time ahead and specifications are very active. We quote steel bands at 1.70c., with extras as per the steel bar card, and steel hoops at 1.90c., f.o.b. Pittsburgh.

Iron and Steel Bars.—Local mills are sold up on steel bars through first quarter and are not entering any new orders for delivery before second quarter. The new demand for iron bars is very active, and for the first time in more than two years local mills that roll iron bars are running to full capacity. Heavy inquiries for steel rounds for export are still being received, but very little of this business is placed here, as the mills are filled up. It is claimed that steel rounds for export have sold at 4.50c. per lb. for delivery through first half of 1916. On most sizes of merchant steel bars mills are back in deliveries eight weeks or longer. We quote steel bars at 1.70c. for delivery through first quarter; refined iron bars, 1.65c. to 1.70c., and railroad test bars, 1.75c. to 1.80c., in carloads and larger lots, f.o.b. Pittsburgh. Steel bars from stock in warehouse are selling at 2c. up to 2.25c. for prompt delivery.

Shafting.—Makers are not selling much shafting on new orders, as they are sold up for six months or longer, and in nearly all cases refuse to quote. It is said that shafting in carload lots for reasonably prompt shipment has recently sold at 45 per cent off list. For shipment at convenience of the mills, we quote cold-rolled shafting at 52 per cent off in carloads, and 47 per cent in less than carloads, f.o.b. Pittsburgh.

Merchant Steel.—Orders received and shipments made by two local mills in November broke all records. Specifications are piling into the mills, and they are back in deliveries at least two months, consumers in most cases not getting more than 25 to 30 per cent of the amount named in their contracts. Prices are very firm. On small lots, for shipment at convenience of the mill, we quote: Iron finished tire, ½ x 1½ in. and larger, 1.90c. base; under ½ x 1½ in., 2.05c.; planished tire, 2.10c.; channel tire, ¾ to ⅞ and 1 in., 2.40c. to 2.50c.; 1 x ⅛ in. and larger, 2.80c.; toe calk, 2.50c. to 2.60c., base; flat sleigh shoe, 2.25c.; concave and convex, 2.30c.; cutter shoe, tapered or bent, 2.80c. to 2.90c.; spring steel, 2.50c. to 2.60c.; machinery steel, smooth finish, 2.30c.

Wrought Pipe.—The demand for wrought iron and steel pipe is getting steadily heavier and mills are now operating to about 85 per cent of capacity. An advance in prices of black pipe is looked for within the next week. Discounts are firmly held.

Boiler Tubes.—Effective Wednesday, Dec. 1, discounts on steel and charcoal-iron tubes were lowered one point, equal to an advance of $2 per ton. The new demand for boiler tubes is enormously heavy and mills are back in shipments six weeks or longer. On seam-

less steel tubes, local makers say they are practically sold up through first half of next year.

Nuts and Bolts.—Owing to the great scarcity and the very high prices ruling for rods, makers state that another advance in prices, probably 10 per cent, will have to be made in the near future. The new demand continues heavy, and in many cases export orders are being turned away, as local makers cannot make deliveries wanted. Discounts in effect at this writing are as follows:

Common carriage bolts, ⅝ x 6 in., and shorter and smaller, rolled thread, 75; cut thread, 70 & 10; larger or longer, 65 & 5. Machine bolts with h. p. nuts, ⅝ x 4 in., and shorter and smaller, rolled thread, 75 & 5; cut thread, 75; larger or longer, 65, 10 & 5. Machine bolts with c. p. c. t. and r. nuts, ⅝ x 4 in., and shorter and smaller, 70; larger or longer, 65. Forged set screws and tap bolts, 45. Rough stud bolts, 65. Lag screws (cone or gimlet point), 75 & 15. Square nuts, h. p., tapped or blank, $5 off list; hexagon, $5.30 off; c. p. c. t. and r. nuts, tapped or blank, square, $4.50 off; hexagon, all sizes, $5.70 off; plain c. p. square nuts, $4.50 off; plain hexagon nuts, $5 off; semi-finished nuts, 80. Rivets, smaller than ½ in. in diameter, 70, 10 & 10. All the foregoing prices are f.o.b. Pittsburgh, subject to an actual freight allowance not to exceed 20c. per 100 lb. on shipments of 300 lb. or more.

Cold-Rolled Strip Steel.—Makers state that the new demand is not very active, most consumers being covered by contracts placed some time ago at lower prices than are ruling now. On current small orders, premiums over regular prices are easily obtainable for prompt shipment. Mills are now sold up for about six months, and are running to 100 per cent capacity. The new extras given below have been adopted by all the makers. We quote cold-rolled steel, 1½ in. and wider, under 0.20 carbon, sheared or natural mill edge, per 100 lb., $3.50, delivered. Extras are as follows:

0.10 to 0.19 Carbon—1½ In. and Wider

Coils			Lengths 24 In. and Over	
Hard	Soft		Hard	Soft
Base	$0.25	100 and heavier	$0.10	$0.35
$0.05	0.30	0.050 to 0.099	0.20	0.45
0.20	0.45	0.035 to 0.049	0.35	0.60
0.35	0.75	0.031 to 0.034	0.60	1.00
0.45	0.85	0.025 to 0.030	0.85	1.25
0.55	0.95	0.020 to 0.024	1.05	1.45
1.35	1.35	0.017 to 0.019	2.45	2.45
1.75	1.75	0.015 to 0.016	2.85	2.85
2.45	2.45	0.013 to 0.014	3.70	3.70
2.80	2.80	0.012	4.30	4.30
3.15	3.15	0.011	4.65	4.65
3.50	3.50	0.010	5.00	5.00

Extras for soft apply for all intermediate tempers.

Coke.—The coke market has quieted down, as nearly all consumers of blast furnace coke are under cover for first half, and, in some cases, for all of next year. Youngstown and Cleveland interests have recently closed for about 100,000 tons of coke per month, part of it at flat prices and the remainder on sliding scales. The supply of furnace coke for prompt shipment is larger, and prices are not very firm. We quote standard makes of blast furnace coke for prompt shipment at $2.10 to $2.15 per net ton at oven, and report sales of about 150 cars, most of it at $2.15. Standard makes of blast furnace coke on contracts for first half of 1916 are held at $2.40 to $2.50 per net ton at oven, some makers refusing to sell at less than the higher price. Standard makes of 72-hr. foundry coke for prompt shipment are held at $2.75 to $2.85, and on contracts from $3 to $3.25 per net ton at oven. The Connellsville *Courier* gives the output of coke in the upper and lower Connellsville regions for the week ended Nov. 20 as 433,402 net tons, an increase over the previous week of about 6021 tons.

Old Material.—It is estimated that in the past two weeks Youngstown and local consumers of scrap have bought from 150,000 to 200,000 tons. One Youngstown interest is credited with having taken 50,000 tons or more and another about 20,000 tons, while a leading local consumer is said to have bought 40,000 to 50,000 tons. This has naturally cleaned up nearly all the heavy steel scrap available for prompt shipment. The market is therefore very strong and higher on all grades of steel scrap for open-hearth purposes. It is said that dealers have paid as high as $17.50 for selected heavy steel scrap to cover short sales. Bids have gone in on the Pennsylvania and Baltimore & Ohio lists, and the prices which the scrap of these two roads will bring this month will likely be the highest in over two years. The sales of selected heavy steel scrap made the past week were at prices ranging from $16.50 to $17, delivered, the lower price having been paid in the early sales. Borings and turnings are higher, and steel locomotive axles have had a sensational advance of $6 to $7 per ton. It is doubtful if much heavy steel scrap could be picked up at less than $17.50, and some dealers are said to be quoting $18. A sale of 1000 tons of low phosphorus melting stock is reported at $20.50, and 1200 tons of borings at above $10, delivered. Dealers quote for delivery in the Pittsburgh and nearby districts that take the same rates of freight, as follows, per gross ton:

Heavy steel melting scrap, Steubenville, Follansbee, Brackenridge, Sharon, Monessen, Midland and Pittsburgh delivery	$17.25 to $17.50
Compressed side and end sheet scrap	14.25 to 14.50
No. 1 foundry cast	14.50 to 14.75
Bundled sheet scrap, f.o.b. consumers' mills, Pittsburgh district	12.50 to 12.75
Rerolling rails, Newark and Cambridge, Ohio, Cumberland, Md., and Franklin, Pa.	17.00 to 17.25
No. 1 railroad malleable stock	14.00 to 14.25
Railroad grate bars	9.75 to 10.00
Low phosphorus melting stock	20.00 to 20.50
Iron car axles	22.00 to 22.50
Steel car axles	24.00 to 25.00
Locomotive axles, steel	21.00 to 22.00
No. 1 busheling scrap	13.50 to 14.00
Machine shop turnings	9.25 to 9.50
Old carwheels	13.00
Cast-iron borings	10.25 to 10.50
*Sheet bar crop ends	16.50 to 17.00
Old iron rails	16.00 to 16.50
No. 1 railroad wrought scrap	16.00 to 16.50
Heavy steel axle turnings	12.00 to 12.50
Heavy breakable cast scrap	13.50 to 14.00

*Shipping point.

Chicago

CHICAGO, ILL., Nov. 30, 1915.

New business in finished steel products for which the mills are finding a place is of minor consequence contrasted with the total inquiry. The extent to which manufacturing will feel the shortage of steel in the first half grows more threatening, and buyers seem increasingly inclined to discard reasonable conservatism in the endeavor to secure future protection. So insistent has been the request for reservations in third and fourth quarter of next year, regardless of price, that some of the mills have booked such business. For shapes and plates for shipment in two or three weeks limited tonnages have been taken in the past week at prices up to 1.95c. at the mill. Store prices have been advanced $2 per ton. In sheet quotations there is a wide variation, with only a limited number of mills in a position to fill orders. New business placed last week included 5000 tons for the Calumet elevator of the Chicago & Northwestern Railroad, at South Chicago, 5000 tons of bridge steel for the same road and 4600 tons of reinforcing bars taken by the Inland Steel Company. The local elevated railway contracted for 1500 tons of 80-lb. rails. Sales of Southern pig iron included approximately 10,000 tons to one interest, the iron being purchased on the basis of $13.50, Birmingham, while the local valve and fittings manufacturer took several thousand tons of Northern and Southern iron. Local furnaces have advanced their prices to a minimum of $18. The scrap market continues exceedingly active, with further advances in prices.

Pig Iron.—A substantial tonnage was added to the obligations of both local and Southern furnaces by reason of last week's purchases. For several of its plants, favorably located for handling Southern iron, one interest bought about 10,000 tons, the prices for the various grades purchased being on the basis of $13.50, Birmingham, for No. 2. Other sales of the week brought $14 for Southern iron in lots up to 1000 tons. A number of cars of spot iron have been sold, the market absorbing them readily at a premium of 50c. per ton. Local furnaces have advanced their prices to the level of $18, with at least one interest asking $18.25. The charcoal-iron market, while it seems not to have reached the level of the highest quotations named, is generally up 50c. per ton to the basis of $16 at the furnace for the cheapest grades. The following quotations are for iron delivered at consumers' yards,

except those for Northern foundry, malleable Bessemer and basic iron, which are f.o.b. furnace, and do not include a switching charge averaging 50c. per ton:

Lake Superior charcoal, Nos. 2 to 5	$17.75 to $18.75
Lake Superior charcoal, No. 1	18.25 to 19.25
Lake Superior charcoal, No. 6 and Scotch	18.75 to 19.75
Northern coke foundry, No. 1	18.50 to 18.75
Northern coke foundry, No. 2	18.00 to 18.25
Northern coke foundry, No. 3	17.50 to 17.75
Southern coke, No. 1 f'dry and 1 soft	18.00 to 18.50
Southern coke, No. 2 f'dry and 2 soft	17.50 to 18.00
Malleable Bessemer	18.00 to 18.25
Standard Bessemer	18.50
Basic	17.50
Low phosphorus	27.00 to 27.50
Silvery, 8 per cent	25.50
Silvery, 10 per cent	26.50

Rails and Track Supplies.—A fairly active inquiry for spikes and bolts is reported, but in general the railroads are now postponing their orders, inasmuch as delivery conditions and prices offer little advantage to the purchaser. The Chicago Elevated Railways has ordered 1500 tons of 80-lb. rails. We quote standard railroad spikes at 2c. to 2.10c., base; track bolts with square nuts, 2.40c. to 2.50c., base, all in carload lots, Chicago; tie plates, $34, f.o.b. mill, net ton; standard section, Bessemer rails, Chicago, 1.25c., base, open hearth, 1.34c.; light rails, 25 to 45 lb., 1.34c.; 16 to 20 lb., 1.39c.; 12 lb., 1.44c.; 8 lb., 1.49c.; angle bars, 1.50c., Chicago.

Structural Material.—Practically no plain material can be placed with the mills of this district, and, except in the few instances where an Eastern mill is specializing in early deliveries at premium prices, it is equally difficult to secure structural shapes in sizes 15 in. and under from any mill. An aggregate of about 800 tons of shapes placed with an eastern Pennsylvania mill at 1.90c. and 1.95c., f.o.b. mill, for delivery within three weeks, is an example of premiums willingly paid. Contracts of the week for fabricated steel included 5000 tons for bridge work for the Chicago & Northwestern Railroad, taken by the Chicago Bridge & Iron Company, and 5000 tons for its elevator at South Chicago, awarded to the Mount Vernon Bridge Company. The St. Paul Foundry Company will furnish 450 tons for the Minnesota Historical Society Building at St. Paul; the American Bridge Company, 560 tons for the Robeson Building, Champaign, Ill.; the Wisconsin Bridge & Iron Company, 425 tons for the Chicago & Northwestern ore docks at Ashland, Wis., and the John Eichlay & Son Company, 300 tons for a Northwestern railroad freight house at Sioux City, Iowa. The carbuilders are continuing to take contracts for cars, including recent orders from the Soo Line for 250 ore cars, about 600 cars of various types from the Chicago, Indianapolis & Louisville and 150 from the Chicago & Alton, but the steel mills report no recent bookings of car steel. For plain material the market continues at 1.70c., Pittsburgh, and we quote for Chicago delivery from mill 1.889c.

The price of structural steel has been advanced by local jobbers to the basis of 2.30c. for Chicago delivery.

Plates.—Offerings of attractive plate specifications are going begging in this market, while in one instance a customer readily agreed to a price of 1.90c., f.o.b. mill, on an overspecification of his contract to the amount of 300 tons. We quote for Chicago delivery of plates from mill 1.889c.

The quotation on plates out of store has been advanced $2 per ton, and we quote for Chicago delivery 2.30c.

Sheets.—The number of mills still able to take orders for galvanized sheets is more limited than at any time, and prices range up to 5c., Pittsburgh, for No. 28, although business is being done on the basis of 4.75c. The available supply of blue annealed and black sheets is likewise so restricted that quotations vary through a wide range, 2.75c., Chicago, being done for black and 2.25c. for blue annealed. We quote for Chicago delivery from mill, No. 10 blue annealed, 2.189c.; No. 28 black, 2.689c.; No. 28 galvanized, 4.439c.

Advances in store prices for galvanized sheets have followed each other rapidly, the latest quotation being on the basis of 4.70c. for No. 28. We quote for Chicago delivery from jobbers' stock as follows, minimum prices applying on bundles of 25 or more: No. 10 blue annealed, 2.40c.; No. 28 black, 2.75c.; No. 28 galvanized, 4.35c.

Bars.—The interesting feature of the week was the sale by the Inland Steel Company of 4600 tons of reinforcing bars, of which 3500 tons was for the Pennsylvania Terminal and the remainder for the Calumet elevator at South Chicago. It is understood that this steel will be worked into existing rolling schedules with a promise of reasonably prompt delivery. It was expected that this business would be placed with interests specializing in deformed bars. The bar-iron mills, although they are not heavily booked ahead, are conserving their capacity, and prices are exceedingly firm. Rail steel bars have been advanced to 1.80c. We quote mill shipments, Chicago, as follows: Bar iron, 1.60c. to 1.70c.; soft steel bars, 1.889c.; hard steel bars, 1.80c.; shafting, in carloads, 58 per cent off; less than carloads, 53 per cent off.

We quote store prices for Chicago delivery: Soft steel bars, 2.20c.; bar iron, 2.20c.; reinforcing bars, 2.20c., base, with 5c. extra for twisting in sizes ½ in. and over and usual card extras for smaller sizes; shafting 45 per cent off.

Rivets and Bolts.—For forward delivery the recent advance in prices of bolts is being well maintained, but for prompt shipment business can be placed on the basis of discounts at least 10 per cent more favorable. The capacity for prompt shipment orders is, however, limited. For rivets prices rule very high, but the Pittsburgh basis of 2.40c. is not being adhered to without exception in this territory. We quote as follows: Carriage bolts up to ⅝ x 6 in., rolled thread, 75; cut thread, 70-10; larger sizes, 65-5; machine bolts up to ⅝ x 4 in., rolled thread, with hot pressed square nuts, 75-5; cut thread, 75; larger sizes, 65-10-5; gimlet point coach screws, 75-15; hot pressed nuts, square, $5 off per cwt.; hexagon, $5.30 off per cwt. Structural rivets, ¾ to 1¼ in., 2.40c. to 2.55c., base, Chicago, in carload lots; boiler rivets, 10c. additional.

We quote out of store: Structural rivets, 2.60c.; boiler rivets, 2.70c.; machine bolts up to ⅝ x 4 in., 75-10; larger sizes, 70-5; carriage bolts up to ⅝ x 6 in., 75-5; larger sizes, 70 off; hot pressed nuts, square, $5.75, and hexagon, $6.25 off per cwt.

Old Material.—The buying of steel scrap, which so strongly influenced the market of the preceding week, was continued last week. A round tonnage of heavy melting and shoveling steel was taken at prices ranging from $15.25 to $15.50. Still further buying of steel scrap by the large steel companies is expected, and the market continues to be strongly influenced by the expectation of shortage in the supply of scrap. Rolling-mill grades have shared in the upward movement, particularly those forms salable for open-hearth furnace charging. Last week also brought increased activity in foundry scrap and No. 1 cast and malleable scrap have advanced 75c. a ton. We quote for delivery at buyers' works, Chicago and vicinity, all freight and transfer charges paid, as follows:

Per Gross Ton

Old iron rails	$16.00 to $16.50
Relaying rails	19.50 to 20.50
Old carwheels	14.50 to 14.75
Old steel rails, rerolling	15.75 to 16.25
Old steel rails, less than 3 ft	15.25 to 15.50
Heavy melting steel scrap	15.00 to 15.50
Frogs, switches and guards, cut apart	15.00 to 15.50
Shoveling steel	14.75 to 15.25
Steel axle turnings	9.50 to 10.00

Per Net Ton

Iron angles and splice bars	$15.75 to $16.00
Iron arch bars and transoms	16.75 to 17.00
Steel angle bars	13.50 to 14.00
Iron car axles	18.50 to 19.00
Steel car axles	20.50 to 21.00
No. 1 railroad wrought	14.50 to 15.00
No. 2 railroad wrought	13.75 to 14.25
Cut forge	13.75 to 14.25
No. 1 busheling	12.75 to 13.00
No. 2 busheling	9.00 to 9.50
Pipes and flues	11.50 to 12.00
Steel knuckles and couplers	13.75 to 14.00
Steel springs	14.50 to 14.75
No. 1 boilers, cut to sheets and rings	10.75 to 11.25
Boiler punchings	13.25 to 13.75
Locomotive tires, smooth	13.50 to 13.75
Machine shop turnings	8.00 to 8.50
Cast borings	7.25 to 7.50
No. 1 cast scrap	13.75 to 14.25
Stove plate and light cast scrap	10.50 to 11.00
Grate bars	10.50 to 11.00
Brake shoes	10.00 to 10.50
Railroad malleable	13.75 to 14.00
Agricultural malleable	11.50 to 12.00

Wire Products.—The amount of new business in wire is light, but the activity of jobbers and dealers in building up their stocks in all lines is making for heavy specifications against existing contracts. We quote to jobbers as follows: Plain wire, No. 9 and coarser, base, $1.939; wire nails, $2.089; painted barb wire, $2.239; galvanized barb wire, $2.939; polished staples, $2.239; galvanized staples, $2.939, all Chicago.

Cast-Iron Pipe.—Municipal lettings for the near future include 500 tons at Mishawaka, Ind., 700 tons at Sheboygan, Wis., and 800 tons at Dayton, Ohio. Other smaller jobs are reported. We quote as follows, per net ton, Chicago: Water pipe, 4 in., $29; 6 in. and larger, $27, with $1 extra for class A water pipe and gas pipe.

Philadelphia

PHILADELPHIA, PA., Nov. 30, 1915.

The demand on the steel mills is more pressing than ever, and most deliveries are subject to the convenience of the mills. Much as it may be desired to take care of the requirements of customers, rolling schedules constitute the determining factor. Quotations on plates, shapes and bars are about where they were a week ago, but in some directions it is asked why prices should be advanced when there is nothing to sell. An Eastern mill declined to take an order for 3000 tons of steel rounds at 3.75c. A leading plate mill is oversold. Structural fabricators are getting numerous orders in a quiet sort of way, and are specifying heavily for the material. Foundry pig iron is stronger and a good tonnage is moving, although the bulk of the inquiries before the trade are for one carload to 500 tons. Two or three orders for good-sized lots of pipe iron and No. 2 plain iron are reported. Basic is quiet. The buying of low phosphorus is quieter for the reason that its makers are sold up. An Eastern steel mill has bought ore for the making of low phosphorus pig iron. Small lots of scrap are moving more actively, and it is expected that the strength of the Western market will soon be reflected here.

Pig Iron.—The bulk of the inquiries now before the trade are for lots ranging from carloads to 500 tons and for miscellaneous grades. One of the few large inquiries is from a local cast-iron pipe company, which asks bids on 5000 tons of pipe iron for delivery in March and April. Another is from the Southern Railway, which wants about 3000 tons for first quarter and 3000 tons for second quarter, several grades being specified, including Nos. 2 and 3 foundry, gray forge, etc. With those who have quoted minimum prices the week has been active and a good aggregate has been disposed of, despite the pessimistic tone of some of the trade last week. An eastern Pennsylvania brand, prompt deliveries of which have been held at $17, furnace, or approximately $17.75, delivered, and which represented the bottom of the market, has been advanced to $17.50, furnace, or approximately $18.25, delivered, this year or first quarter. Another eastern Pennsylvania brand is quoted at $18.90, delivered. There is every indication that spot iron will soon command premiums. Orders placed include one for 2000 tons of pipe iron, Eastern delivery, at $17, furnace, and another of 6000 tons of No. 2 plain, for delivery from now to the end of the first quarter, also at $17, furnace. Eastern Pennsylvania gray forge is now held at $17.25 to $17.75, delivered. Virginia No. 2 X, which is scarce, is quoted at $18.50 to $18.75, delivered. Virginia No. 2 plain is held at $18 to $18.50, delivered. Shipments of Virginia iron are holding up well, smaller consumers, in particular, pressing for deliveries. Basic has been quiet, the quotations for nearby deliveries running from $17.75 to $18, delivered. Stocks of standard low phosphorus are practically exhausted, and its makers are not seeking business as they are sold up for the next couple of months. They quote $30 to $32, delivered. Makers of Lebanon low phosphorus are in similar position, and for their product $29, furnace, is about the market. An eastern Pennsylvania steel company has purchased ore for the making of standard low phosphorus. Quotations for standard brands, delivered in buyers' yards, prompt shipment, range about as follows:

Eastern Penna., No. 2 X foundry	$18.25 to $18.75
Eastern Penna., No. 2 plain	18.00 to 18.50
Virginia, No. 2 X foundry	18.50 to 18.75
Virginia No. 2 plain	18.00 to 18.50
Gray forge	17.25 to 17.75
Basic	17.75 to 18.00
Standard low phosphorus	30.00 to 32.00

Iron Ore.—Arrivals at this port in the week ended Nov. 27 consisted of 6400 tons from Chile and 6658 tons from Sweden. No new business is reported. It is stated that for the three cargoes of Spanish low phosphorus ore whose purchase was reported a week ago a price higher than 10½c. per unit was paid. Incidentally, delivery is to be earlier than between March and June, as was stated.

Ferroalloys.—For 80 per cent ferromanganese the quotation is unchanged at $100, seaboard, although a single carload is said to have brought $115. Fair tonnages of both prompt and future are moving. An Eastern maker is reported to have withdrawn offerings. Arrivals of English ferromanganese at this port last week totaled 1167 tons. For 50 per cent ferrosilicon quotations are unchanged at $83 to $85, Pittsburgh.

Bars.—With the quotation for steel bars at 1.70c., Pittsburgh, or 1.859c., Philadelphia, premiums are easily obtainable for prompt deliveries, all of which are made at the convenience of the mills. The demand is good, and some of the makers continue to refrain from quoting. For a lot of 3000 tons of steel rounds 3.75c. was offered to an eastern Pennsylvania mill, but met with a declination. Iron bars of a good grade are quoted at about 1.70c., Pittsburgh, equal to 1.859c., Philadelphia, or at 1.80c., f.o.b. Eastern mill.

Plates.—Quotations are fairly uniform at 2c., Pittsburgh, or 2.159c., Philadelphia, on current business. First quarter contracts are quoted at 2.25c., Pittsburgh, or 2.409c., Philadelphia, but those quoting this price are admittedly oversold. Other makers have taken business at less than 1.959c., Philadelphia, but over 1.859c.

Structural Material.—Quotations are unchanged at 1.70c., Pittsburgh, or 1.859c., Philadelphia, on desirable propositions, 1.85c., Eastern mill, on current business and 2c. Eastern mill, on miscellaneous business. Makers are filled up with orders for the ordinary sizes of shapes, the larger ones being easier. Much work is being let quietly, and the demand from the fabricators is good. The American Car & Foundry Company will require about 1000 tons for a building at Milton, Pa. The Lukens Iron & Steel Company will require 3000 tons for its addition at Coatesville, 1500 tons of which will be supplied by the Eastern Steel Company and 1500 tons by the Lackawanna Bridge Company. An extension to the Frankford elevated line, this city, will take about 3000 tons. The Lackawanna Bridge Company will supply 600 tons for the electrification of the Chestnut Hill branch of the Pennsylvania Railroad.

Billets.—But little change is noted in the situation. Some makers are out of the market and others can get fancy prices for what they can deliver. Open-hearth soft rerolling billets are quoted at about $36, Philadelphia, and forging billets, $45 to $55.

Sheets.—The demand, especially for prompt shipment, is growing stronger and prices are advancing. No. 10 blue annealed sheets are quoted by Eastern makers at 2.40c., Pittsburgh, equal to 2.599c., Philadelphia.

Coke.—Some good business in both furnace and foundry coke is pending, much of which would have been closed, but for unwillingness on the part of consumers to pay prices asked. Prompt furnace is quoted at $2.25 to $2.50 per net ton at oven and contract furnace at $2.50 to $2.75, with a probability that $2.35 could be done. Prompt and contract foundry is quoted at $3 to $3.50. Freight rates from the principal producing districts follow: Connellsville, $2.05; Latrobe, $1.85, and Mountain, $1.65.

Old Material.—While the mills are not yet active buyers, there is a pronounced betterment in the movement of small lots. Dealers who are short have offered $15.50 for heavy melting steel, and it is believed that the strength prevailing in the West must soon be felt in this district. Several grades have been advanced. Quotations for delivery in buyers' yards in

this district, covering eastern Pennsylvania and taking in freight rates from 35c. to $1.35 per gross ton, are as follows:

No. 1 heavy melting steel	$15.00 to $15.50
Old steel rails, rerolling	16.75 to 17.25
Low phos. heavy melting steel scrap	20.00 to 20.50
Old steel axles	21.00 to 22.00
Old iron axles	22.00 to 23.00
Old iron rails	17.50 to 18.00
Old carwheels	14.50 to 15.00
No. 1 railroad wrought	17.50 to 18.00
Wrought-iron pipe	13.50 to 14.00
No. 1 forge fire	12.00 to 12.50
Bundled sheets	11.50 to 12.00
No. 2 busheling	9.50 to 10.00
Machine shop turnings	10.25 to 10.50
Cast borings	10.25 to 10.75
No. 1 cast	15.00 to 15.50
Grate bars, railroad	11.00 to 11.50
Stove plate	11.00 to 11.50
Railroad malleable	11.00 to 11.50

Buffalo

BUFFALO, N. Y., Nov. 30, 1915.

Pig Iron.—Demand continues to be urgent for all grades, and one of the largest producers of the district is virtually out of the market for first half iron. About 18,000 tons, all grades for prompt, first and second quarter delivery, was placed in the week. A large volume of inquiry for last half delivery is coming in, but furnaces are refusing to quote beyond first half. The majority of the furnaces of the district are now holding to an $18 minimum for all grades. A notable feature of the week was the sale of a small tonnage of malleable iron for prompt shipment at $20 at furnace, a transaction which introduces $20 iron into this market for the first time since 1907. High silicon irons are becoming scarcer, and the little obtainable commands $18.50 to $19. One producer reports inability to quote on anything above 3 per cent silicon. Basic is now held at $18 to $18.50, with $19 asked for special low sulphur. Foundries of the district are ordering on contracts as rapidly as possible, because of increasingly heavy business and the fear of a car shortage later. In some instances consumers are calling for iron bought for January, February and March delivery. Buffalo selling agents of the largest producer of charcoal iron in the Lake Superior district received instructions by wire yesterday to stop making quotations on all grades of charcoal iron until further notice. To-day the announcement is made that the price on all regular grades has been advanced $2 per ton. For current and first quarter and first half delivery we quote as follows, f.o.b. furnace, Buffalo:

No. 1 foundry	$18.00 to $19.00
No. 2 X foundry	17.50 to 18.50
No. 2 plain	17.00 to 18.00
No. 3 foundry	17.00 to 18.00
Gray forge	17.00 to 18.00
Malleable	18.00 to 19.00
Basic	18.00 to 18.50
Charcoal, regular brands and analysis	21.00 to 22.00

Finished Iron and Steel.—The sold-up condition of mills for months ahead and the extension of deliveries are acting as a bar to new placement. Many contracts are being specified ahead in anticipation of monthly quotas, which is really one of the reasons for the present acute congestion. There has been no price change in the week, 1.70c., Pittsburgh, still being the nominal base price for bars, plates and shapes and also for steel sheet piling. It is stated that some selling agencies are quoting 2c. for less than carload lots, and business is being thrown more and more to jobbers, so far as they are able to meet the demand. Warehouse prices have been advanced $3 per ton on bars and small shapes and $1 on plates and structural shapes, making prices as follows, f.o.b. Buffalo: Bars, except rounds and squares 2 in. and over, 2.35c., base; rounds and squares 2 in. and over, 2.70c., base; structural shapes and universal mill and sheared plates, 2.35c., base; steel hoops, 2.90c., base, 5c. extra per 100 lb. being charged for "store door" delivery. The Buffalo Bolt Company is now completing a new finishing mill for making bolt stock from billets. Bids are in to-day on 700 tons of structural steel for addition to the plant of the Union Carbide Company at Sault Ste. Marie, Mich. The Buffalo Structural Steel Company has 100 tons for the Buffalo General Hospital. The new power plant for the Buffalo General Electric Company on Niagara River, just below Buffalo, will require 4000 tons of structural steel.

Old Material.—The past week has been the most active one in the scrap iron market in this district for a number of years, with price advances in nearly all commodities. Transactions in heavy melting steel predominated, with an advance of $1 per ton. For several small lots of select No. 1 heavy melting steel as high as $17, f.o.b. Buffalo, has been paid. The demand for low phosphorus scrap continues strong, and the price has advanced 50c. per ton. Old steel axles have advanced $1, and old iron axles 50c. to $1. Old carwheels and cast scrap are strong and appear to have struck the upward gait, with indications pointing to their following pig-iron advances closely, having been marked up 50c. per ton for the week. We quote dealers' asking prices, per gross ton, f.o.b. Buffalo, as follows:

Heavy melting steel	$15.50 to $16.00
Low phosphorus steel	19.50 to 20.00
No. 1 railroad wrought scrap	14.50 to 15.00
No. 1 railroad and machinery cast scrap	14.25 to 14.75
Old steel axles	20.50 to 21.00
Old iron axles	21.00 to 21.50
Old carwheels	14.50 to 15.00
Railroad malleable	14.50 to 15.00
Machine shop turnings	7.00 to 7.50
Heavy axle turnings	11.50 to 12.00
Clean cast borings	8.00 to 8.50
Old iron rails	16.00 to 16.50
Locomotive grate bars	10.50 to 11.00
Stove plate (net ton)	9.00 to 9.50
Wrought pipe	12.00 to 12.50
Bundled sheet scrap	11.00 to 11.50
No. 1 busheling scrap	12.50 to 13.00
No. 2 busheling scrap	10.50 to 11.00
Bundled tin scrap	12.00

Cleveland

CLEVELAND, OHIO, Nov. 30, 1915.

Iron Ore.—Shipments are well cleaned up and the December movement will be lighter than was expected. The Steel Corporation shipped its last cargo Saturday and most of the shippers are through at Lake Superior ports. November shipments are expected to be about 4,500,000 tons. Shippers are in the market for vessel tonnage for 1916, but little is to be had. A number of vessel owners are apparently holding back a portion of their tonnage with the expectation that there will be a very good wild charter market next year. In spite of the present scarcity of available tonnage, shippers believe there will be sufficient vessel capacity to bring down all the ore next year, even if the movement reaches the most sanguine expectations. However, in view of the existing conditions, a number of shippers are negotiating for the purchase of vessels for carrying their ore. No new capacity can be provided in addition to that already contracted for, as the Lake shipyards are filled up and can take no additional orders for boats for delivery before the close of navigation next year. While some reservations are being made, no actual sales of ore are as yet reported. We quote 1915 prices as follows, delivered at lower Lake ports: Old range Bessemer, $3.85; Mesaba Bessemer, $3.45; old range non-Bessemer, $3; Mesaba non-Bessemer, $2.85.

Pig Iron.—Only a moderate amount of new business is coming out but market is very firm and prices are higher. The Cleveland price is now $17, furnace, for No. 2 foundry, basic and malleable iron, and one interest has advanced to $17.50 for shipment from its Cleveland and other furnaces. Foundry iron is quoted at $16.75 for No. 2 at Toledo, but this price will probably be advanced shortly. Some inquiry has come out for the last half of next year but furnaces are refusing to quote prices that far ahead. Most furnaces having iron left for first-half delivery are disposed to hold it for higher prices, and one Cleveland interest is now asking $18 for foundry iron at its Valley furnace. A Mansfield consumer has purchased 1000 tons of Nos. 1 and 2 foundry iron for the first half, and there is an inquiry from Mansfield, Ohio, for 500 tons each of Northern and Southern iron for the second and third quarter. Ohio silvery iron is active and furnaces are behind on shipments. The price has been advanced to a minimum of $24 for 8 per cent silvery for any delivery until July 1.

Southern iron is quiet and is generally quoted at $14, Birmingham, for No. 2, although some early shipment iron can still be had at $13.50. We quote, delivered Cleveland, as follows:

Bessemer	$17.95 to $18.45
Basic	16.95 to 17.30
Northern No. 2 foundry	17.30
Gray forge	16.30
Jackson Co. silvery 8 per cent silicon	25.62
Standard low phos., Valley furnace	30.00

Coke.—The demand for foundry coke on contracts is heavy and consumers are having some trouble in getting shipments as fast as desired. The market is not active, although some business is coming out, mostly in spot shipment orders. Prices are firm at $3 to $3.50 per net ton at oven for standard Connellsville coke for prompt shipment and contract. Furnace coke is quoted at $2.35 to $2.50 for contract.

Finished Iron and Steel.—Specifications are very heavy, and there is considerable new demand, but most mills are refusing to take additional orders, holding their unsold tonnage for whatever are the prevailing market prices next spring when they are caught up on deliveries. Plate prices have advanced in the local market to 2.25c., sales in lots larger than carloads being made at that price for delivery in six or eight weeks. Eastern mills are quoting plates at 2c. to 2.25c., Pittsburgh. The Hydraulic Pressed Steel Company, Cleveland, has placed additional orders for 47,000 tons of steel bars for 4½ to 6 in. British shells for delivery in 1916. Of this steel 40,000 tons is for shell orders recently placed and 7000 tons for 200,000 shells taken in the last few days. A Youngstown manufacturer recently placed 5000 tons of billets for Russian shells and has an inquiry out for 9000 tons of 4½-in. bars for French shells. Other large shell contracts are pending. Structural work is more active than for some time. The Massillon Bridge & Structural Company has taken 420 tons for a factory building for the Morgan Engineering Company, Alliance, Ohio, and 240 tons for a forge shop for the Forsburgh Forging Company, Cleveland, and the Riverside Bridge Company has taken 300 tons for a factory building for the Winton Engine Works, Cleveland. Bids are being taken for 1500 tons for a Pennsylvania Railroad freight terminal in Indianapolis and for 550 tons for a State University Building at Bloomington, Ind. Forging billets have sold at $55 for the first quarter delivery. Makers of hard steel bars have advanced prices $2 a ton to 1.60c. at mill. Cleveland warehouse prices have been advanced to 2.40c. for steel bars, plates and shapes, this being $3 a ton advance on bars and $1 a ton advance on plates and structural material. Steel bars, 2 in. and larger in size, are now quoted at 2.65c. out of stock.

Bolts, Nuts and Rivets.—The demand for bolts and nuts is heavy, but not much business in the way of first quarter contracts is being placed. Prices are firm at the recent advance. Most rivet consumers placed contracts for the first quarter before the recent price advance. Specifications on contracts are heavy, and there is a good volume of new business. We quote rivets at 2.40c., Pittsburgh, for structural and 2.50c. for boiler rivets. Bolt and nut discounts are as follows:

Common carriage bolts ¾ by 6 in., smaller or shorter, rolled thread, 75 per cent, cut thread, 70 and 10; larger or longer, 65 and 5; machine bolts with h.p. nuts ¾ by 4 in., smaller or shorter, rolled thread 75 and 5, cut thread 75, larger and longer 65, 10 and 5; lag bolts, gimlet or cone point 75 and 15; square h.p. nuts, blanked or tapped, $5 off the list; hexagon h.p. nuts, blank or tapped, $5.30 off; c.p.c. and t. square nuts, blank or tapped, $4.50 off; hexagon nuts, all sizes, $5.70 off; cold pressed semi-finished hexagon nuts, all sizes, 80 off.

Old Material.—The market is very firm and fairly active. Trading, however, is almost entirely between dealers who are buying to cover recent orders. Local mills as well as those in Youngstown are well covered with scrap for the next three or four months. An embargo has been declared against the Brier Hill Steel Company. Steel car axles have again advanced, some being sold in this market at $22.50 for export. Iron axles have advanced $1 or more a ton. The only weak item on the scrap list is stove plate, large quantities of which are coming in from country districts. We quote, f.o.b. Cleveland, as follows:

Per Gross Ton

Old steel rails	$15.00 to $15.25
Old iron rails	16.00 to 17.00
Steel car axles	22.50 to 23.00
Heavy melting steel	15.25 to 15.50
Old carwheels	12.25 to 12.50
Relaying rails, 50 lb. and over	22.50
Agricultural malleable	11.50 to 12.00
Railroad malleable	14.75 to 15.25
Steel axle turnings	12.50 to 12.75
Light bundled sheet scrap	11.75 to 12.00

Per Net Ton

Iron car axles	$19.00 to $20.00
Cast borings	7.00 to 7.25
Iron and steel turnings and drillings	6.25 to 6.50
No. 1 busheling	11.50 to 11.75
No. 1 railroad wrought	14.00 to 14.50
No. 1 cast	12.50 to 13.00
Railroad grate bars	9.75 to 10.00
Stove plate	9.50

Cincinnati

CINCINNATI, OHIO, Dec. 1, 1915.—(*By Wire.*)

Pig Iron.—Michigan melters have lately taken some round lots of iron, included in sales made last week being one of 5000 tons of Southern for December shipment. A like tonnage of Virginia iron was also taken for first half movement by another consumer there, and approximately 1000 tons of Southern went to the same territory. In southern Ohio two concerns bought 500 tons each of Southern foundry for first half shipment, and a number of Indiana melters took lots ranging from 100 to 600 tons. A northern Ohio company contracted for 500 tons of Northern foundry, but other Northern foundry sales reported are for smaller tonnages. A quiet sale of 10,000 tons of Northern basic was made in this territory for delivery before July 1. Both basic and malleable are scarce. The consumption of the latter has increased rapidly the past few weeks. A Kentucky melter is expected to close for 500 tons of Southern foundry before the week is over, and there are a few scattered general inquiries from Ohio and Indiana for both Northern and Southern foundry. All Southern furnaces are to-day on a minimum price basis of $14, Birmingham, for prompt and first half shipment, but two at least are firm at $14.50. The recent transactions in resale iron have cut down the amounts held by different interests so heavily that $14, Birmingham, is now generally quoted, but some business is still being taken with shipments extending through the first quarter, and in a few instances through the entire first half of next year, at $13.50. Northern foundry has been advanced to $17, Ironton, for first half delivery. The silvery irons are also higher and $24 at furnace is now considered minimum, with the furnaces unwilling to take on much long time business at this figure. Based on freight rates of $2.90 from Birmingham and $1.26 from Ironton, we quote, f.o.b. Cincinnati, as follows:

Southern coke, No. 1 f'dry and 1 soft	$17.40 to $17.90
Southern coke, No. 2 f'dry and 2 soft	16.90 to 17.40
Southern coke, No. 3 foundry	16.40 to 16.90
Southern No. 4 foundry	15.90 to 16.40
Southern gray forge	15.40 to 15.90
Ohio silvery, 8 per cent silicon	25.26 to 25.76
Southern Ohio coke, No. 1	19.26 to 19.76
Southern Ohio coke, No. 2	18.26 to 18.76
Southern Ohio coke, No. 3	17.76 to 18.26
Southern Ohio malleable Bessemer	18.26 to 18.51
Basic, Northern	18.26 to 18.51
Lake Superior charcoal	19.20 to 20.20
Standard Southern carwheel	24.40 to 24.90

(*By Mail*)

Coke.—A little better inquiry for foundry coke is noted, but it is mostly confined to limited tonnages for shipment in the first quarter of next year. Some interest is also taken in furnace coke, but no open inquiries are out for large tonnages. The reported car shortage has not yet seriously affected deliveries. We quote Connellsville 48-hr. coke around $2.50 to $2.60 per net ton at oven for either prompt or future shipment, but as low as $2.35 can be done on a few brands for nearby movement. Wise County and Pocahontas furnace coke is higher and quotations are named by different producers ranging from $2.75 to $3. Foundry coke in all three fields is around $3.15 to $3.50 per net ton at oven, with a few interests holding at $3.75.

Finished Material.—The nearby mills are quoting No. 28 galvanized sheets at 5.15c., f.o.b. Cincinnati, or Newport, Ky., and No. 28 black at 2.65c. A limited quantity of No. 28 galvanized sheets may be obtained from local stores to-day around 4.75c. The local store price on No. 10 blue annealed sheets is 2.60c., and on steel bars 2.35c., with $5 per ton added for sizes running 2-in. and over in diameter. The retail price on structural shapes is 2.45c. The warehouse business is very good and is reported fully 30 per cent more than for the month of October.

Old Material.—Another advance in prices has been made of approximately 25c. per ton and considerable business is reported, especially in scrap used by the rolling mills. Some large tonnages have been placed in the Central West lately. The stove dealers are also buying more scrap than for a long time. The minimum figures given below represent what buyers are willing to pay for delivery in their yards, southern Ohio and Cincinnati, and the maximum quotations are dealers' prices, f.o.b. at yards:

Per Gross Ton

Bundled sheet scrap	$10.00 to $10.50
Old iron rails	13.75 to 14.25
Relaying rails, 50 lb. and up	21.25 to 21.75
Rerolling steel rails	12.75 to 13.25
Heavy melting steel scrap	11.75 to 12.25
Steel rails for melting	11.75 to 12.25

Per Net Ton

No. 1 railroad wrought	$10.75 to $11.25
Cast borings	7.25 to 7.75
Steel turnings	6.75 to 7.25
Railroad cast scrap	11.25 to 11.75
No. 1 machinery cast scrap	12.75 to 13.25
Burnt scrap	8.25 to 8.75
Iron axles	17.00 to 17.50
Locomotive tires (smooth inside)	11.00 to 11.50
Pipes and flues	8.50 to 9.00
Malleable and steel scrap	9.75 to 10.25
Railroad tank and sheet scrap	7.75 to 8.25

Birmingham

BIRMINGHAM, ALA., Nov. 29, 1915.

Pig Iron.—Sales of Birmingham pig iron in November have reached something like the production, which was over 200,000 tons. The largest foundry-iron producer sold largely over its make. Other interests report a considerable business and a scarcity of certain grades. On Friday of last week one of the active iron companies advanced its price to $14.50 for second quarter and declined business offered at $14. The leading interest is selling freely at $13.50 for first half, but is alone in that quotation. The largest foundry-iron maker quotes a minimum of $14 for first half and is limiting the quantity to every customer, pending further advances. The minimum on spot is $13.50, and not all producers will sell at that because their output is so well taken care of ahead. Special irons have been booked far in the future at as high as $16, and $17 is predicted for the Clifton brand of the Alabama Company. A firm offer of $16 for 3000 tons of this iron for second half delivery was declined. Of special interest to the trade is the arrangement made by the Sloss-Sheffield Steel & Iron Company for the shipment of its iron made at Sheffield and Florence on the Tennessee River in extreme northern Alabama by the Arrow Transportation Company and the St. Louis Packet Company to Metropolis, Brookford and Cairo, where it will be delivered for further transportation to railroads. The Interstate Commerce Commission decided recently that it was not the business of the railroads to inquire whether iron received by them at junction points came via land or water. Hence the Sheffield and Florence iron must be accepted at these junction points on the same divisional rates as though it came by rail. The Sloss-Sheffield Company thus secures a great advantage over other Alabama makers above the differential of 25 to 40c. per ton which it already enjoyed on rail by reason of closer proximity to competitive fields. The company has three blast furnaces in this field. It resumed iron making at its fifth furnace in Birmingham the past week. Shipments are heavy. One interest will not have any iron on yards after December if that which has been ordered is shipped. The Gulf States Steel Company will resume at its Alabama City furnace as soon as repairs are completed. It has enough iron on hand to last it pending the shutdown. The inquiry for iron continues brisk, and the tendency to advance is still strong. We quote, per gross ton, f.o.b. Birmingham district furnaces, as follows:

No. 1 foundry and soft	$14.00 to $14.50
No. 2 foundry and soft	13.50 to 14.00
No. 3 foundry	13.00 to 13.50
No. 4 foundry	12.75 to 13.25
Gray forge	12.50 to 13.00
Basic	13.50 to 14.00
Charcoal	22.00 to 22.50

Cast-Iron Pipe.—Conviction grows with the local water and gas pipe manufacturers that this is going to be the busiest winter in many years. The inquiry is very active, and the volume of new business received is most satisfactory. Steady operation for some time is guaranteed. The usually dull season bids fair to reverse itself. We quote, per net ton, f.o.b. makers' yards, as follows: 4-in., $23.50; 6-in. and upward, $21.50, with $1 added for gas pipe.

Coal and Coke.—The coke market is strong and prices have risen 25c. on good foundry. The additional active beehive ovens find their capacity well taken care of. Foundries are inquiring for large lots for future delivery. We quote, per net ton, f.o.b. oven, as follows: Beehive furnace, $2.75 to $3; foundry, $3.25 to $3.50, with some brands at $3.75. By-product prices rule 25c. per ton under beehive. Coal is brisker, although the large mines feel the inroads of hydroelectric plants, which, it is figured, have reduced the Alabama coal consumption from 1,000,000 to 1,500,000 tons per annum. Domestic mines are doing a good business. The Pratt Consolidated Coal Company has let a contract to a Mobile firm for ten more barges for use on the Warrior River, to operate between Cordova, at the head of navigation, and ports on the Gulf of Mexico.

Old Material.—Scrap dealers report an active week and yards with very little stock on hand. Prices accord with quotations. All steel scrap is in demand and it is difficult to secure sufficient of it. We quote, per gross ton, f.o.b. dealers' yards, as follows:

Old iron axles	$14.50 to $15.00
Old steel axles	14.00 to 14.50
Old iron rails	13.50 to 14.00
No. 1 railroad wrought	10.50 to 11.00
No. 2 railroad wrought	9.50 to 10.00
No. 1 country wrought	9.00 to 9.50
No. 1 machinery cast	10.00 to 10.50
No. 1 steel scrap	10.00 to 10.50
Tram carwheels	10.00 to 10.50
Stove plate	8.00 to 8.50

St. Louis

ST. LOUIS, MO., Nov. 29, 1915.

Pig Iron.—Sales of pig iron continue to show a satisfactory total, but they have ranged from 350 tons downward. Practically all have been purchases by small foundries to cover contracts already placed and to run through the first quarter, with some through the first half. An inquiry for 75 tons of ferromanganese is noted and a number of small ones for pig iron.

Finished Iron and Steel.—Deliveries continue more extended and the price for structural material is no longer the immediate consideration, 1.70c., Pittsburgh, being firmly held. No large tonnages are being ordered, but small lots are keeping the total above normal. Fabricators are busy. Recent business placed includes 900 tons for two storage houses for the East St. Louis Cotton Oil Company taken by the Lackawanna Bridge Company, 650 tons by the Spuck Iron & Foundry Company of St. Louis for a local theater building and about 500 tons for a small office building which has gone to the Christopher & Simpson Company. Tank plates are in light request but firmly held. Standard section steel rail transactions have included a large tonnage for the Missouri Pacific-Iron Mountain receiver, about 25,000 tons in all, which has been divided. Track fastenings are in good request and bars have been taken freely, both reinforcing and ordinary. Movement out of warehouse has been active for which we quote as follows: Soft steel bars, 2.25c.; iron bars, 2.20c.; structural material, 2.35c.; tank plate, 2.35c.; No. 10 blue annealed sheets, 2.65c.; No. 28 black sheets, cold rolled, one pass, 2.80c.; No. 28 galvanized sheets, black sheet gage, 5.05c.

Coke.—New demand has been light, but requests for prompt shipments under contracts and for the advancement of allotments have been more numerous.

Old Material.—Scrap has been active and feverish during the week, with the local industries taking some, but most of the nervousness has been due to the desire of dealers to cover their shortages. There is a good demand for shipment away and prices as quoted are firmly held. Anticipation of improved business is developing the gambling spirit and this accounts for a proportion of the activity. Local inspection is becoming stiffer, but there are no embargoes existing, the rejections resulting from the care exercised as a consequence of the higher prices being sufficient for the present to prevent excessive stocking of material in the yards. Relaying rails are more active and the price is very firmly held. There is a shortage of this material in this section and supplies are being shipped in here from the near Eastern territory. We quote dealers' prices, f.o.b. customers' works, St. Louis industrial district, as follows:

Per Gross Ton	
Old iron rails	$14.50 to $15.00
Old steel rails, rerolling	15.00 to 15.50
Old steel rails, less than 3 ft.	15.00 to 15.50
Relaying rails, standard section, subject to inspection	21.00 to 23.00
Old carwheels	13.00 to 13.50
No. 1 railroad heavy melting steel scrap	14.25 to 14.75
Heavy shoveling steel	12.00 to 12.50
Frogs, switches and guards cut apart	14.25 to 14.75
Bundled sheet scrap	9.00 to 9.50
Per Net Ton	
Iron angle bars	$14.50 to $15.00
Steel angle bars	13.00 to 13.50
Iron car axles	18.50 to 19.00
Steel car axles	19.00 to 19.50
Wrought arch bars and transoms	16.50 to 17.00
No. 1 railroad wrought	13.00 to 13.50
No. 2 railroad wrought	12.50 to 13.00
Railroad springs	13.00 to 13.50
Steel couplers and knuckles	13.50 to 14.00
Locomotive tires, 42 in. and over, smooth inside	12.75 to 13.25
No. 1 dealers' forge	9.75 to 10.25
Mixed borings	8.00 to 8.50
No. 1 busheling	11.00 to 11.50
No. 1 boilers, cut to sheets and rings	8.50 to 9.00
No. 1 railroad cast scrap	11.00 to 11.50
Stove plate and light cast scrap	8.75 to 9.25
Railroad malleable	10.00 to 10.50
Agricultural malleable	9.00 to 9.50
Pipes and flues	9.00 to 9.50
Railroad sheet and tank scrap	8.25 to 8.75
Railroad grate bars	9.00 to 9.50
Machine shop turnings	8.50 to 9.00

San Francisco

SAN FRANCISCO, CAL., Nov. 23, 1915.

Current needs continue light in most lines, but conditions are favorable for much greater local activity in the near future. Stocks have been held down rather closely, and, in view of the increasing delay in deliveries, merchants and consumers are greatly concerned over their supply for the first half of next year. Shortage of stocks in the winter and spring is freely predicted, and buyers are anxious to make contracts as far ahead as possible, as well as to accelerate shipments on orders already placed. The foreign demand is strong in several lines, and the business done is apparently limited by the inability of the mills to make deliveries.

Bars.—In view of the rather slack consuming demand, merchants have until recently been disposed to hold off. Now, however, all the mills on the Pacific coast are fairly snowed under, largely with foreign business, and it is difficult to get deliveries from the East within a reasonable time. Specifications have been coming out freely of late, and many contracts have been placed for extended delivery, but it is expected that requirements will soon exceed the supply. Inquiries ranging from single carloads to 1000 tons or more, usually on attractive specifications, are coming from many parts of the Orient. Local mills quote about 2.10c. on large lots, but are well sold up for some time ahead, and the jobbing price has advanced to 2.90c.

Structural Material.—While fabricating business is slow to develop, there has been quite a general movement among local fabricators and other consumers to place contracts for the coming year. Considerable complaint is made of slow deliveries for work now in hand, and it is expected that many building projects will be retarded by the scarcity and high prices. The local warehouse price on carloads to the trade is now 2.45c. As for new fabricating contracts, Dyer Brothers have a small highway bridge in Santa Cruz County, and the Central Iron Works has a fair tonnage for a Catholic church on Geary Street. General contracts have been let for an addition to the Security National Bank's building and for an 8-story class A building at Sixth and Los Angeles streets, both in Los Angeles. Plans have been finally adopted for a viaduct at the foot of Market Street, this city, and arrangements are being made for two additional buildings at the San Francisco Hospital. Plans are expected shortly for the Sacramento hall of justice.

Rails.—There is not much local business in standard sections, but merchants show more interest in light rails than for a long time. Stocks are pretty well cleaned up, and a desire to replenish is indicated by a number of good sized inquiries. Orders from railroads and industrial consumers are small and not very numerous.

Plates.—Most large consumers have closed contracts covering their requirements for some time to come, and contracts have also been placed by many of the jobbers. Increasing tardiness of deliveries has also greatly stimulated specifications on contracts already placed. A few mills are still offering fairly good delivery, but supplies from most quarters are coming through very slowly. Stocks are light, and the jobbing price is quoted at 3.05c. While no important new construction work has appeared, the shipbuilding outlook is encouraging. Considerable foreign business has been done.

Sheets.—The trade is showing more interest in blue annealed, and a good many first quarter contracts are said to have been placed at 1.75c., Pittsburgh. The demand for black is limited, and both buyers and sellers are very cautious in their attitude toward galvanized, the consuming demand for which is quiet.

Wrought Pipe.—Some mills have booked a fair tonnage here this month, but on the whole business is quiet, especially on merchant sizes, as most of the plumbing supply houses are fairly well supplied and the jobbing trade is slow. The only urgent demand is for seamless goods, as some of the railroads are greatly in need of boiler tubes, and it is practically impossible to get anything for prompt delivery.

Cast-Iron Pipe.—Municipal business continues quiet. The city of Santa Cruz ordered a carload Nov. 16, and Pasadena will be in the market Nov. 30 for a small lot. Aberdeen, Wash., will take bids Dec. 8 for 4000 ft. of 6-in. class C pipe. Private corporations are getting actively into the market, especially gas companies in some of the larger cities. Prices at Pacific coast terminals are quoted as follows, per net ton: $33 for 6-in. and over; $35 for 4-in., and $1 extra for class A and gas pipe.

Pig Iron.—No foreign iron has arrived for some time, and supplies on hand are pretty well cleaned up, while the outlook for future shipments is by no means encouraging. The local market is accordingly much stronger, and melters who had not already covered their late winter and spring requirements are placing contracts for various brands of Southern and Eastern iron. No. 1 Southern foundry iron is now quoted at $26 per gross ton, San Francisco.

Coke.—The situation in coke is similar to that in pig iron, foreign supplies, either on hand or to arrive, being limited. Contracts for domestic material are increasing. Foreign coke at the yards is still quoted at $15 to $16 per net ton, and the most popular Eastern brands of foundry coke sell around $15.

Old Material.—The present activity of Pacific coast steel mills, with the probability that they will continue busy as long as the war lasts, has greatly strengthened the market for steel melting scrap, and in some cases dealers are getting the prices for which they have been holding, obtaining as high as $12 per gross ton for some classes of material, while in other lines purchases can still be made as low as $6. While

cast scrap shows a little more firmness, in sympathy with pig iron, there seems to be plenty available, and little can be sold above $15 per net ton.

Ferroalloys.—Open-hearth furnace operations in this territory are more extensive than ever before, the raw material used being very largely scrap, and the local demand for ferroalloys is accordingly larger than usual. While there has been some promise of development of local resources in this line, production so far is negligible, and the market is very strong. Some large sales of English ferromanganese have been made, and shipments are now coming through in fairly good shape. Supplies of ferrosilicon are sufficient for current needs, but it is said that there is no prospect of further arrivals until June, which will leave the market very short. The local price is now $140 per ton. There has recently been considerable activity in California manganese and chrome ore properties, and it is reported that some ore is being shipped East, though it is difficult to get definite or reliable information on the matter.

New York

NEW YORK, Dec. 1, 1915.

Pig Iron.—One Lehigh Valley producer has withdrawn from the market for the time being. The last quotation of this company was $17.50 furnace for No. 2 X. A large producer of Lake Superior charcoal iron is also out of the market. In the Buffalo district two furnace companies have very little iron to sell for the first half. Their quotation on No. 2 X foundry iron is $17.50 for the first quarter and $18 on malleable. The two Tonawanda furnaces in that district cannot be started before navigation opens, in view of inability to get ore. In this market there have been some fair sales in the past week by offices with eastern Pennsylvania furnace connections and some Buffalo iron has been sold, but consumers are not making any scramble for iron. Production is increasing but not greatly. Temple furnace, long owned and operated by the anthracite railroads, will be started up under a new ownership shortly. The higher prices for eastern Pennsylvania iron are due in part to advances in ore for next year, sales of New Jersey ore having been made to the extent of 100,000 tons or more in the past ten days at 8½ cents a unit delivered. Early in the year these ores sold at 7 cents and one year ago at as low as 6½ cents per unit. Among inquiries before the trade is one for 2000 tons for the International Steam Pump Company for delivery in the first quarter. Generally sales of the past week have been in lots of 200 to 500 tons, few being as large as 1000 tons. The Virginia situation is very strong. One more furnace in that district can go in and it is being put in shape to resume. On No. 2 plain iron the quotation of the Virginia Iron, Coal & Coke Company is still $15.25 at furnace for the first half. Another Virginia producer is quoting $16.50 for No. 2 X and $16 for No. 2 plain. We quote Pennsylvania irons at tidewater as follows for this year's delivery: No. 1 foundry, $18.25 to $18.50; No. 2 X, $17.75 to $18; No. 2 plain, $17.25 to $17.50. Southern iron at tidewater, $18.50 to $18.75 for No. 1 and $18 to $18.25 for No. 2 foundry and No. 2 soft.

Ferroalloys.—Sales of 700 to 800 tons of British ferromanganese for delivery in the early part of 1916 are noted, as well as small lots transactions for early delivery. There are some indications that consumers who had large stocks and whose old contracts are expiring are not very fully covered for the future. Receipts from England are reported satisfactory. While they have probably been larger in November than in October, the total is not likely to exceed 60 per cent of normal, and nearly all of this is delivered on contracts. Some sales of domestic ferromanganese are reported. The spiegeleisen market is strong and active. Recent sales amount to 4000 to 5000 tons at $28 to $30, furnace, for delivery into the first half of 1916. Inquiries for 2000 to 3000 tons are also up as well as for 1000 tons for export, but this last is not receiving any attention. Ferrosilicon, 50 per cent, is very strong and hard to get, imports the last three months being much below normal.

Finished Iron and Steel.—The lack of progress in relieving the freight congestion at seaboard railroad terminals, due in part to scarcity of lighterage facilities as well as of ocean-going ships, and the difficulty of consumers getting desired quantities through specifications against contracts are among the features of present market conditions. In some lines at least it would appear that contracts expiring this month will be extended through the first quarter. This will mean, at any rate so far as the mills are concerned, that the going high prices of new purchases will have to be averaged with the much lower rates of contracts. Premium offerings are more common and mill space is found, now and then, for the urgent business, particularly if the tonnage is not very great. No signs of importance are yet noted of a check in buying on account of high prices, but instead the immediate future buying in shapes and plates looks heavy. A local shipyard promising to be an aggressive factor in shipbuilding is inquiring for prices for 10,000 tons of plates, probably for two 9000-ton freight steamships. Another large mercantile building, the Oceanic, Fifth Avenue and Forty-second Street, taking 2000 tons, is about to be closed. There is fairly active figuring on railroad cars; industrial plant extensions continue, and the present month will bring out further large rolled and cast-steel work for New York City's transportation lines, including 28,500 tons bid for on Nov. 30. The unit price incidentally of the lowest bidder averaged about $57.30 per ton erected. Lively expectations of railroad bridge work are still held, though as yet this is measured by 400 tons for the Pennsylvania and 150 tons for the Philadelphia & Reading. About 750 tons, for the Lehigh Valley, is thought to have been placed with the Pennsylvania Steel Company. Among industrial plants it is noted that 650 tons for the Simplex Mfg. Company, New Brunswick, N. J., has been awarded to Milliken Brothers, and 200 tons for a sulphur company at Freeport, Tex., has been placed with the Phoenix Bridge Company. The Eastern Steel and Lackawanna Steel Companies have been awarded the steel work for the Lukens Iron & Steel Company. The George A. Just Company is to erect 700 tons for a theater at Brockton, Mass., and H. S. Kerbaugh, Inc., New York, has the superstructure contract for the $1,500,000 Baltimore & Ohio coal pier at Curtis Bay, Md. Plates are being sold at 2c., Pittsburgh, with deliveries in some cases not promised within three months. Structural material has commanded $1 and more above the 1.70c., Pittsburgh base, with sales, however, at 1.70c., even with deliveries in a few weeks; and the more important bar-iron mills seem to be strictly maintaining the price of 1.70c., Pittsburgh, though some of the smaller mills, with a limited range of sizes, are possibly shading this price occasionally. In spite of the obvious strength of the market, the Secretary of the Navy appears to believe he can smoke out the mills and has advertised for bids on Dec. 3 on material for two battleships, quotations to be f.o.b. contractor's plant; among other things, 28,700 tons of plates and about 5750 tons of shapes and bars are involved. We repeat last week's quotations as follows: Mill shipments of iron bars, steel bars and shapes at 1.869c., New York, and plates at 1.869c. and 2.169c., New York, the former price in some months and the latter in some weeks. For warehouse buying we quote iron and steel bars at 2.35c., New York, structural material at 2.40c. and steel plates at 2.50c.

Cast-Iron Pipe.—The city of Providence, R. I., will open bids Dec. 6 for 612 tons of 4, 6, 8 and 12 in. No other municipal lettings are reported. Private gas and water companies continue to purchase freely, deliveries running into next spring. Inquiries for export are steadily coming up but apparently rarely materialize into actual business; a sale of 1000 tons for South America is, however, expected to be consummated this week. Prices continue strong. Carload lots of 6-in., class B and heavier, are quoted at $27 per net ton, tidewater, class A and gas pipe taking an extra of $1 per ton.

Old Material.—A better movement is reported in

practically all classes of scrap. Steel companies in eastern Pennsylvania are apparently well stocked and the only demand for that section comes from dealers having contracts to fill. The influence of the active Pittsburgh market is felt in this locality, and prices of steel scrap are advancing to above parity with eastern Pennsylvania. Some rolling-mill buying is strengthening the prices of wrought scrap. Axles are still in demand for export. Brokers are paying about as follows to local dealers and producers, per gross ton, New York:

Old girder and T rails for melting	$13.75 to $14.00
Heavy melting steel scrap	13.75 to 14.00
Relaying rails	20.50 to 21.50
Rerolling rails	15.00 to 15.25
Iron car axles	24.00 to 25.00
Steel car axles	25.00 to 26.00
No. 1 railroad wrought	15.50 to 16.00
Wrought-iron track scrap	14.50 to 15.00
No. 1 yard wrought, long	14.25 to 14.50
No. 1 yard wrought, short	13.75 to 14.00
Light iron	4.50 to 4.75
Cast borings	7.75 to 8.00
Wrought turnings	7.75 to 8.00
Wrought pipe	11.50 to 11.75
Old carwheels	13.00 to 13.50
Malleable cast (railroad)	11.00 to 11.50

Cast scrap is in better demand, with inquiries for quantities running up to 500 tons. Dealers' quotations to consumers of cast scrap are as follows, per gross ton, New York:

No. 1 cast (machinery)	$13.50 to $13.75
No. 2 cast (heavy)	12.50 to 12.75
Stove plate	10.00 to 10.50
Locomotive grate bars	10.00 to 10.50

British Market Strong

Threatened Shortage of Steel—Hematite Iron Scarce—Ferrosilicon Higher

(*By Cable*)

LONDON, ENGLAND, Dec. 1, 1915.

Pig-iron warrants are strong with occasional small reactions on profit taking. More business is being done by consumers and prices are the highest in fifteen years and tending upward. Hematite iron is quoted at 130s., with broad demand at advancing prices; furnaces are sold out into the second quarter and declining to quote. Furnaces in blast are 163, against 167 at the same time last year. Stocks of pig iron in Connal's store at the close of last week were 126,530 tons, against 126,822 tons at the same time one week previous.

Small sales of Welsh sheet bars have been made at £10, but the official minimum quotation is £9 10s. The whole position is unsettled by war conditions and a threatened shortage of steel, causing tin plates and galvanized sheets to advance. Demand for finished steel is good, but works cannot meet it because they are full on national business and quotations are nominal. America is not offering anything and the shipping congestion is unrelieved. We quote as follows:

Tin plates, coke, 14 x 20, 112 sheets, 108 lb., f.o.b. Wales, 21s. 9d. to 22s., against 21s. 6d. last week.

Cleveland pig-iron warrants, 72s. 2d., compared with 71s. 8d. a week ago.

No. 3 Cleveland pig iron, maker's price, f.o.b. Middlesbrough, 72s. 6d., against 72s. a week ago.

Steel black sheets, No. 28, export, f.o.b. Liverpool, £15 10s., nominal, compared with £14 10s. last week.

Steel ship plates, Scotch, delivered local yards, £11 5s.

Steel rails, export, f.o.b. works port, £10 10s.

Hematite pig iron, f.o.b. Tees, 130s.

Sheet bars (Welsh), delivered at works in Swansea Valley, £9 10s., against £9, nominal, a week ago.

Steel joists, 15 in., export, f.o.b. Hull or Grimsby, nominal and unquotable, against £12 5s. a week ago.

Steel bars, export, f.o.b. Clyde, £14 10s., nominal, compared with £14 last week.

Ferromanganese, f.o.b., £20 15s.

Ferrosilicon, 50 per cent, c.i.f., £27, compared with £26 10s., last week.

Trade Position Secure—The Hematite Situation—Finished Steel Very Strong

(*By Mail*)

LONDON, ENGLAND, Nov. 16, 1915.—The pig-iron markets have continued strong with good general buying and chronic and accumulating labor difficulties though, broadly speaking, the situation is being handled with more understanding because of better organizers in our leading government departments, the influence of which is very important. There is a fair outward movement of foundry iron, but it is far below that of peace times. The fundamental trade position is very secure, and the advance which has been witnessed in prices is by no means excessive when due allowance is made for increased costs of output. Production is, of course, restricted and is all wanted, while stocks are low, and a fair proportion of that which is even in sight is already booked for export.

The hematite iron market is taking exactly the course which had been suggested in these letters. The steel makers undertook enormous contracts for deliveries over 1916, in connection with government supplies, but neglected to cover themselves in hematite. The hematite people, not feeling the pressure of demand put off buying their ore. There has been a general revival of demand, and buyers have found it difficult to obtain supplies which seems to have taken them quite by surprise. A few furnaces have lately been changed from Cleveland on to hematite iron, but this has not done much at present to relieve the hematite position, and only adds to the stringency in foundry pig iron. The ore market is tighter. Best Rubio is about 33s., c.i.f. Tees, though a few odd cargoes have been sold for about 32s. 6d.

The finished iron position shows no weakening. Works everywhere report as much on their books as they can undertake and are behind in deliveries. They complain that specifications are reaching them more freely than they desire. As in the pig-iron trade, labor is the bugbear, with little chance for any abatement in the scarcity now that the big recruiting campaign is in full swing. The supply is nothing like equal to the industrial exigencies of the country, even if recruiting stopped at once. The country's ordinary merchant business is becoming beautifully less.

The Welsh steel position is being somewhat cleared up because of conferences which have been held whereby certain of the works are to be permitted to manufacture tin and sheet bars for local tin-plate and galvanized sheet industries, while others are to run exclusively on shell steel.

The tin-plate market is very strong. A line of oil sizes has been done for Japan at 21s. 9½d., tin-lined and iron-hooped, for January shipment, while that country is also inquiring for about 50,000 boxes. We hear nothing of American competition now in tin plates, the position having probably been fundamentally affected by the tin import regulations as regards the United States. In galvanized sheets, what with the steel position and the fresh book in spelter, it is hardly possible to say what prices are. One company has sold 24-gage in bundles at £23 for November shipment, but there are all sorts of prices named, one maker actually asking £27. The whole iron and steel industry of the country is really at sixes and sevens, and it is hardly possible to give close or reliable market quotations.

Japan's imports of pig iron and ingots, classed together, according to E. F. Crowe, commercial attaché to the British embassy at Tokio, were 178,639 tons in 1914 against 278,817 tons in 1913. A falling off was shown from all countries except Sweden, which made a slight gain. Bars and sections decreased from 183,737 tons in 1913 to 153,520 tons, black plates and sheets from 93,087 tons to 87,476 tons, tin plates from 26,307 tons to 25,983 tons, galvanized sheets from 34,025 tons to 19,676 tons, and pipes and tubes from 45,200 tons to 29,149 tons. Machinery imports declined from £3,752,700 in 1913 to £2,546,200 last year.

Flint & Chester, Inc., railroad, mill and contractors' supplies, 237-239 Lafayette Street, New York, who, for the past year or more have had the sales agency of the lubricator made by the National Graphite Lubricator Company, Scranton, Pa., have just entered into a contract to become general sales agents in the United States and Canada covering this product. A branch office will be established in Chicago and traveling engineers will cover different sections of the country. This lubricator is stated to have been approved by 12 railroad companies and is being tried out by approximately 45 others.

Metal Market

NEW YORK, Dec. 1, 1915.

The Week's Prices

Cents Per Pound for Early Delivery

	Copper, New York			Lead		Spelter	
Nov.	Lake	Electrolytic	Tin, New York	New York	St. Louis	New York	St. Louis
24	19.75	19.62½	39.50	5.25	5.20	19.00	18.25
25	19.75	19.62½	39.50	5.25	5.20	19.00	18.25
26	19.87½	19.75	39.75	5.25	5.20	18.75	18.50
27	20.00	19.87½	39.75	5.25	5.20	18.50	18.25
29	20.00	19.87½	39.50	5.25	5.20	18.25	18.00

Copper is quieter but firmer. Buying of tin is practically at a standstill. Lead is strong but less active. Spelter is inactive and prices are lower. Antimony is scarce and quotations are higher.

New York

Copper.—In the last half of last week a lull came in the buying of copper and since that time there has been less doing. With the lull, prices sagged a little but they have gradually worked up to the level of 20c., cash, for Lake, and 19.87½c., cash, New York, for electrolytic. The Lake producers who temporarily withdrew their prices early last week resumed offering again, and on Wednesday and Friday there was some activity, but it did not last long. Consumers are well covered, but would take more copper if they could get it at ⅛c. or ¼c. under the market. The producers, however, are in a comfortable position and are standing pat, while there appears to be no resale metal. The bulk of the very heavy buying of the last two or three weeks was at prices up to 19.75c., cash, New York, although fair sales were made after that figure was exceeded. Large sales on foreign account are still expected. The exports last month totaled 19,396 tons. The London market is very strong.

Copper Averages.—The average price of Lake copper, for the month of November, based on daily quotations in THE IRON AGE, was 18.92c., and of electrolytic, 18.85c.

Tin.—The market has continued dull, irregular and almost devoid of other than negative features. Sales have been small and confined to small lots of spot to care for immediate needs. In fact, the market has come almost to a dead stop. The deliveries into consumption in November totaled 2975 tons, leaving in stocks and landing Nov. 30 1849 tons. The steamer Indrawadi from Singapore and Penang should have arrived Nov. 20 with 1100 tons, but she is now at Bermuda where she put in for coal. The quotation yesterday for spot tin was 39.50c. Predictions that December would see a shortage now look more probable.

Lead.—In this metal conditions are much the same as in copper, inasmuch as the market is firm at sustained prices while business is quieter. The New York quotation yesterday was 5.25c., and that at St. Louis, 5.20c. Consumers' needs are well provided for, and the independent sellers are so comfortably booked with orders that they are not tempted to cut prices. The London market is very strong and should its upward trend continue it is likely to send prices here upward. The best buying now is on foreign account. The exports of November were large, amounting to 5423 tons.

Spelter.—In the latter part of last week the market became dull and easier, a trend which has since continued. Prompt prime Western was quoted yesterday at 18.25c., New York, and 18c., St. Louis. First quarter deliveries can be contracted for at 17c. That a let-up in activity should come is natural in view of the heavy buying of a few days ago. The decline in prices was helped along by the resale of metal by consumers. The exports in November were exceptionally heavy, amounting to 9021 tons.

Antimony.—A few days ago the demand was heavy, but it has tapered off, leaving prices at their high level. Chinese and Japanese grades, spot delivery, are quoted at 40c. to 41c., duty paid. The supply of prompt and nearby is very scarce.

Old Metals.—The market is firm. Dealers' selling prices have still further advanced on some commodities and are now as follows:

	Cents per lb.
Copper, heavy and crucible	18.00 to 18.50
Copper, heavy and wire	17.75 to 18.00
Copper, light and bottoms	16.00 to 16.50
Brass, heavy	12.50 to 13.00
Brass, light	11.00 to 11.50
Heavy machine composition	15.00 to 15.25
No. 1 yellow rod brass turnings	13.00 to 13.50
No. 1 red brass or composition turnings	13.00 to 14.00
Lead, heavy	4.75
Lead, tea	4.50
Zinc	11.00 to 12.00

Chicago

Nov. 29.—Copper sales were heavy last week, but a disposition on the part of some interests to move their holdings checked a further advance in prices. Slight advances are recorded for lead and zinc. We quote: Casting copper, 19.50c.; Lake copper, 20c.; tin, carloads, 40½c.; small lots, 42½c.; lead, 5.22½c.; spelter, nominally, 19c.; sheet zinc, nominally, 22c.; Cookson's antimony, 50c.; other grades, 42c. On old metals we quote buying prices for less than carload lots as follows: Copper wire, crucible shapes, 16.25c.; copper bottoms, 15.25c.; copper clips, 15.50c.; red brass, 13.50c.; yellow brass, 11.50c.; lead pipe, 4.60c.; zinc, 13.75c.; pewter, No. 1, 24c.; tinfoil, 30c.; block tin pipe, 32c.

St. Louis

Nov. 29.—Non-ferrous metals are very firmly held in this market, the quotations to-day being as follows: Lead, 5.40c.; spelter, 20c.; tin, 42c.; copper, Lake, 20c.; copper, electrolytic, 19.50c.; antimony, Asiatic, 43c. In the Joplin ore district there was some weakness in second grade ores. The basis range for zinc blende, 60 per cent, was $85 to $115 per ton. On calamine the price ranged from $70 to $80 for 40 per cent. Lead ore was sold at $70 per ton for 80 per cent. The average for the week's output of the district as sold was for zinc blende, $99.49; calamine, $66.94; lead, $69.55. Miscellaneous scrap metals are quoted as follows: Light brass, 7.50c.; heavy yellow brass, 9.50c.; heavy red brass and light copper, 11c.; heavy copper and copper wire, 13c.; zinc, 7.50c.; lead, 4c.; tea lead, 3.50c.; pewter, 21c.; tinfoil, 30c.

Large Wheat Shipments on Ore Boats

The Shenango Steamship Company, an identified interest of the Shenango Furnace Company, Sharpsville, Pa., recently had five of its ore boats loaded with wheat at Fort William and Port Arthur, Canada, for shipment to Erie and Buffalo. The question was raised by the Canadian authorities as to whether this wheat would be allowed to go out of Canada, but, after extended negotiation, the boats were permitted to proceed. The Wilpen was loaded with 420,000 bushels; W. P. Snyder, Jr., 470,000 bushels; W. P. Snyder, 385,000 bushels; Shenango, 425,000 bushels, and J. M. Schoonmaker, 460,000 bushels, or a total of 2,160,000 bushels. It is understood that a rate of 5c. per bushel was paid to the steamship company. The cargoes are said to be the last wheat that will be allowed to be exported from Canada into this country. Based on a yield of twenty bushels per acre, they represented the crops obtained from 108,000 acres of Canadian farm lands.

Manganese Ore and Ferromanganese Imports

Manganese ore imports into the United States in September are officially returned as 28,989 gross tons, compared with 32,245 tons in September, 1914. The imports in August were double those of September, this year, 57,867 tons. The total for the first nine months of this year is 173,992 tons, against 215,274 tons and 258,104 tons to Oct. 1, 1914, and 1913, respectively, a decrease of 32 per cent from the 1913 figures. The monthly import rate to Sept. 1, 1915, was 18,125 tons, which has been exceeded each month since May.

Ferromanganese imports into this country for October, according to Government data obtained by THE IRON AGE, were 4326 tons, of which 2478 tons was received at Baltimore and 1698 tons at Philadelphia. The October rate is about 52 per cent of normal.

Iron and Industrial Stocks

NEW YORK, Dec. 1, 1915.

Transactions in stocks have shrunk considerably, but values have been well maintained. The buoyant business conditions, the continued foreign demand for all kinds of merchandise and the abundance of funds have prevented any material decline, but the approaching session of Congress induces caution among speculators working for an advance until the President officially announces his policy in his message to Congress. An important development of the week was the sharp rise in Cambria Steel, attributed to the purchase of stock in the open market by interests seeking control of the company. The range of prices on active iron and industrial stocks from Wednesday of last week to Tuesday of this week was as follows:

Allis-Chal., com..	32½- 35⅝	Republic, com...	51 - 52
Allis-Chal., pref.	74⅛- 83	Republic, pref...	109 -110
Am. Can, com...	60 - 64⅝	Sloss, com.....	58 - 60
Am. Can, pref...	110 -113½	Sloss, pref.....	95
Am. Car & Fdy., com.	81¼- 83⅜	Pipe, com.....	25⅛- 26¼
Am. Car & Fdy., pref.	117 -117⅝	Pipe, pref.....	53½
Am. Loco., com..	70¼- 73⅝	U. S. Steel, com..	86½- 88⅛
Am. Loco., pref..	103¼-104¾	U. S. Steel, pref..	115¾-116
Am. Steel Fdries.	60¼- 61⅝	Va. I. C. & Coke.	61 - 63
Bald. Loco., com.	113 -117⅞	West. Electric...	67½- 71
Bald. Loco., pref.	109½-112	Am. Rad., com..	372½-375
Beth. Steel, com.	448 -472	Am. Ship, com...	37½- 39
Beth. Steel, pref.	160½-162	Am. Ship, pref..	79¾- 80
Case (J.I.), pref.	88½- 90	Chic. Pneu. Tool.	82 - 83
Colorado Fuel...	51 - 53¼	Cambria Steel...	68½- 76¼
Deere & Co., pref.	95¼- 97	Lake Sup. Corp..	9½- 10
General Electric.	175½-177⅝	Pa. Steel, com.....	63
Gt. No. Ore Cert.	50 - 51½	Pa. Steel, pref...	83 - 84
Int. Harv. of N. J., com. 108	-111⅜	Warwick	105⅝
Int. Harv. of N. J., pref.	118	Cruc. Steel, com.	73¼- 76¾
Int. Harv. Corp., com.	69½- 70	Cruc. Steel, pref.	109⅜-112¼
Int. Harv. Corp., pref. 106		Harb-Walk, Refrac., com.	69
Lackawanna Stl.	81¾- 85¼	Harb-Walk, Refrac., pref.	98¼- 99
N. Y. Air Brake.	137 -143½	La Belle Iron, com.	53¼- 54
Nat. En. & Stm., com.	28¼- 30½	Am. Brit. Mfg., pref.	80 - 85
Nat. En. & Stm., pref.	94 - 94½	Can. Car & Fdy., com	94 - 96½
Pitts. Steel, pref.	100 -101¾	Can. Car & Fdy., pref. 107	-115
Pressed Stl., com.	65 - 67½	Carbon Stl., com.	80 - 90
Pressed Stl., pref.	105 -105¼	Carbon Steel, 1st pref.	80
Ry. Steel Spring, com.	45¼- 47½	Carbon Steel, 2nd pref.	65
Ry. Steel Spring, pref. 102		Driggs-Seabury ..	147 -190
		Midvale Steel....	77 - 79¾

Dividends

The Baldwin Locomotive Works, semi-annual, 3½ per cent, on the preferred stock, payable Jan. 1. No action was taken by the directors as to resumption of dividends on the common stock.

The International Harvester Company of New Jersey, regular quarterly, 1¼ per cent on the common stock, payable Jan. 15. No action was taken by the directors on the common dividend of the International Harvester Corporation.

The Pittsburgh Steel Company, 3½ per cent on the preferred stock, or one-half of the 7 per cent accumulated dividend in arrears, payable Dec. 22.

The National Steel Car Company of Canada, stock dividend of 14 per cent and a cash dividend of 7 per cent on the preferred stock. Regular payments at the rate of 7 per cent on the senior issue are now in order, all accumulated dividends on the issue having been provided for.

The Boston Belting Company, regular quarterly, $2, per share, payable Jan. 1.

The Railway Steel Spring Company, regular quarterly, 1¾ per cent on the preferred stock, payable Dec. 20.

The Pettibone-Mulliken Company, regular quarterly, 1¾ per cent on the preferred stock, payable Jan. 3.

The Yale & Towne Mfg. Company, regular quarterly, 1¾ per cent, payable Jan. 3, and an extra dividend of 5 per cent, payable Dec. 23.

Electrical drive will be provided for the nine new mills that will be installed by the Trumbull Steel Company, Warren, Ohio. Seven of these are hot mills, and two are jobbing mills. The mills will be driven by a 2250-hp. motor, and electricity will be furnished by the Trumbull Public Service Company.

President Henry B. Joy of the Packard Motor Car Company, Detroit, Mich., in a recently published interview, stated that his company is engaged in seeking to develop aeroplane motors of in the neighborhood of 100 hp. and 200 hp. for light scout aeroplanes and heavier duty aeroplanes.

Germany's Supply of High-Grade Manganese Ore

Germany, though a large consumer of high-grade manganese ores, occupies an insignificant position as a producer of such ores, according to the German Imperial Statistical Bureau. An investigation showed that the output of iron ore containing less than 12 per cent of manganese, mostly from Siegerland, was 2,274,702 tons in 1908, rising progressively to 2,877,995 tons in 1912; that one having from 12 to 30 per cent manganese increased from 279,676 tons in 1908 to 300,077 tons in 1912; while ore possessing a higher content than 30 per cent was only about 100 tons.

It is evident, therefore, that the increasing requirements of the steel industry have been met by imports of high-grade manganese ore. In 1900 such imports amounted to only 204,420 tons, but in 1913 they had risen to 680,371 tons, compared with 523,132 tons in 1912. The 1913 imports of 680,371 tons were made up of 446,942 tons from Russia, 177,658 tons from India, 27,467 tons from Spain, and 21,873 tons from Brazil. The consumption of manganese ores by German blast furnaces was 622,485 tons of ore having more than 30 per cent manganese in 1913, compared with 500,447 tons in 1912. The Luxemburg consumption, not included in the above, was 129,852 tons in 1912.

The German Steel Trade in October

The statement of the German Steel Works Union, issued after its regular meeting on Oct. 28, 1915, gives the following general review of the condition of the German steel trade:

In semi-finished steel, business has changed but little either in domestic demand or with neutral countries. Sales for the next few months are expected to equal the average of recent months. In railroad material orders placed by the Schwerin State railroads for 1916 are less than for the previous year, while the requirements of the Saxon State railroads exceed those of last year. Business with neutral countries has been considerable. Grooved rails are quiet, while the demand for mine rails has not lessened. Demand for shapes has changed but little since the last report, being quiet owing to little activity in building. Business with neutral countries is still good, since shipbuilding and fabricating shops are well occupied.

Germany's Steel Output for September

The German steel production for September was 1,174,350 metric tons, the largest since the war started, comparing with 1,158,702 tons in August, according to official data in *Stahl und Eisen*. This is also the highest daily rate, 45,167 tons, the best previous being 44,546 tons per day in August last. The September output in 1914 was 663,223 at 25,509 tons per day. This year's September production was made up of Bessemer steel ingots, 594,229 tons; open-hearth ingots, 494,750 tons; steel castings, 64,337 tons; crucible steel, 8415 tons, and electric steel 12,619 tons. The output to Oct. 1, 1915, was 9,617,878 tons, against 12,224,877 tons to Oct. 1, 1914. The daily press cabled report of the October output showed 1,214,855 tons.

British Manganese Ore Imports Increasing

Imports of manganese ore into Great Britain in October were 60,931 gross tons, which is the largest for any month since the war began except in August, 1914, when diversions caused the imports to amount to 78,156 tons. These October receipts compare with 38,210 in October, 1914. The next best import totals were 50,435 tons in September, 1914, and 45,045 tons in September, 1915. Total imports for the first ten months of this year are 270,745 tons, against 444,975 tons to Nov. 1, 1914.

Brazilian manganese ore is again quoted (Nov. 19) in England at 3s. 6d. (85c.), while Indian ore is commanding 2s. 2d. (52c.) for this year's shipment, and 2s. 1½d. (51c.) for next year's shipment, both c.i.f. East Coast.

Reed-Prentice Sold to Boston Interests

Boston investors headed by Robert F. Herrick have bought the common stock (par value, $750,000) of the Reed-Prentice Company, the largest machine tool plant in Worcester, Mass. The deal was closed at Boston Nov. 24 and was followed by the resignation of the entire board of directors. The voting power of the company lies in the common stock, and at a meeting in Worcester Nov. 26 a new board was elected as follows: Robert F. Herrick, Malcolm Donald, Robert C. Morse, Henry P. Kendall and George C. Lee, of Boston; Frank A. Drury, Homer Gage and Albert E. Newton, of Worcester. The directors elected these officers: President, Robert F. Herrick; vice-president and general manager, Albert E. Newton; treasurer and clerk, Jeremiah J. Mackin; general counsel, Charles M. Thayer. The officers and directors who retired from the board were Lucius J. Knowles, president; George Crompton, treasurer and clerk; Harry W. Smith and Charles M. Thayer.

Robert F. Herrick, the new president, is also president of the Pacific Mills, a $12,000,000 corporation; chairman of the directors of the Saco-Lowell Shops, a $3,600,000 corporation, and an official or trustee of numerous other textile, banking and manufacturing corporations. He is a member of the law firm of Fish, Richardson, Herrick & Neave of Boston. George C. Lee is of the firm of Lee, Higginson & Company of Boston and Frank A. Drury is a banker. The re-election of Albert E. Newton as vice-president and general manager is taken to indicate that there is to be no change in the operating staff.

The statement is given out that the new owners buy for investment and that there is no connection with the Morgan, Remington or Phillips interests. Most of the new directors and officials are closely associated with Mr. Herrick, and some of the former may be replaced. It is also reported that there will be no adjustment of the present capitalization of $2,000,000, and that no merger or consolidation with other companies is proposed.

Belgium's Iron and Steel Output in 1913

Belgium's pig-iron production in 1913, according to delayed data recently published, was 2,484,600 metric tons, including 840 tons of spiegeleisen and ferromanganese. In 1912 the total was 2,301,290 tons. Imports in 1913 were 579,410 tons and exports 16,750 tons. Blast furnaces in operation were fifty-four in nineteen plants, with 5289 employees. The output of steel ingots and castings was 2,466,630 tons, of which 61,850 tons was castings. The 1912 output was 2,515,040 tons. In 1913 there were twenty-six open-hearth furnaces, eighty-four converters and 135 reheating and other furnaces operating. Finished steel output was 448,400 tons and the finished iron 304,350 tons in 1913. Iron-ore and scrap consumption in 1913 was 6,860,130 tons, of which 84,900 tons was Belgian ore.

Cupro-titanium is being used to eliminate gases and deleterious substances from copper and copper alloys for casting purposes. Charles Vickers of Niagara Falls, N. Y., has been granted a patent (U. S. 1,151,744 —Aug. 31, 1915), assigned to the Titanium Alloy Mfg. Company of that city, which has as its object the retaining of the effects of the titanium and the further improvement of the metal. He adds an alloy of copper, titanium and magnesium to the molten bath. The titanium is believed to combine with the oxygen and other impurities forming titanic acid, while the magnesium compounds unite with these to form slags so fusible that they are entirely eliminated. An alloy that may be used is 5 per cent titanium, 93 per cent copper and 2 per cent magnesium. About 10 min. is said to be necessary to eliminate the impurities.

The J. E. Moss Iron Works, Wheeling, W. Va., has secured the contract for furnishing the structural steel and ornamental iron work for the Marion high school, Marion, Ohio, requiring about 300 tons of steel. Marriott, Allen & Hall, Columbus, are the architects.

Harris Engine Company Reorganized

The William A. Harris Steam Engine Company, Providence, R. I., for more than fifty years manufacturer of the Harris-Corliss engine, has been sold to the Harris-Corliss Engine & Machine Company, a corporation recently organized with an authorized capital of $400,000, of which $200,000 is preferred stock. When E. Francis Crowell, treasurer, general manager and owner of all the stock of the old Harris Company, died last February, the Superior Court appointed Wendell P. Mackintosh, of the Stillman-White Foundry Company, Providence, as receiver. Later the company was adjudged bankrupt, and Mr. Mackintosh was elected trustee in bankruptcy.

The plant has been in continuous operation under the direction of Judge Arthur L. Brown and Nathan W. Littlefield, referee in bankruptcy, and the creditors have received dividends of 50 per cent and expect more. The trustee was authorized to sell the company's assets free of liens and the transfer to the new corporation has been completed. The officers of the new company are Edgar J. Lowenstein, president, Volney M. Wilson, Jr., vice-president; Hugh F. MacColl, treasurer; Rush Sturgess, secretary; Edgar J. Lowenstein, Volney M. Wilson, Jr., Hugh F. MacColl, Frank L. Hinckley, John B. Lewis, Edward B. Aldrich and Wendell P. Mackintosh, directors. Mr. Mackintosh is to be general manager and Frank Gibson general engineer and sales agent. Much new machinery is being installed in the plant, which is located on Promenade Street, adjoining the Brown & Sharpe Mfg. Company.

National Enameling & Stamping Operations

Officials of the National Enameling & Stamping Company say that its Eastern business has been running close to record figures for the past three months. Sales for this district are made through the New York office, where a considerable portion of the export trade is also handled. The company's Western, Southern and Southwestern business is likewise showing a marked improvement. Augmented export trade has accounted for some of the gain, but the largely increased demand in the United States is the most encouraging feature of the situation, as it makes for greater stability than so-called war orders. The company's rolling mills, which are at St. Louis, Mo., and Granite City, Ill., are working at capacity night and day. About 60 per cent of the sheets and tin plate produced by these mills is being sold for outside consumption, realizing the high prices now ruling in the trade. At these mills the coal used costs only 95c. per ton, delivered. The company is now reaping the benefit of its contracts for pig iron and other raw materials made many months ago, before the rise started in the metals and chemicals needed in the manufacture of its products.

Lackawanna Steel Company Additions

Appropriations have been made by the Lackawanna Steel Company for the building of two new stationary furnaces at its No. 2 open-hearth steel plant at Buffalo. They will be of 80 tons capacity, like the four stationary furnaces already operated at this plant alongside two large tilting furnaces. There are foundations in for two more stationary furnaces, so that the No. 2 plant will ultimately have eight stationary furnaces. The No. 1 plant has 14 stationary furnaces. The construction has also been authorized of an 8 and 10 in. merchant bar mill for the rolling of small sizes. The new mill will probably be completed in the latter part of next year. The open-hearth furnaces, it is expected, will be operated by spring.

The Burdett Oxygen Company, whose executive offices are at 1401-5 Jackson Boulevard, Chicago, will complete Dec. 15 the erection of its plant at Twenty-third and Jones streets, Fort Worth, Tex., which is designed to supply the local trade with electrolytic oxygen 99½ per cent pure. The Texas plant is the ninth erected by the Burdett company in the various industrial centers of the country.

PERSONAL

Dr. John A. Brashear, president American Society of Mechanical Engineers, was honor guest at a dinner given by more than 1000 of his friends in the Soldiers' Memorial Hall, Pittsburgh, Nov. 24, in honor of the seventy-fifth anniversary of his birth. C. M. Schwab, chairman Bethlehem Steel Company, Ambrose Swasey, Cleveland, Ohio, and others of note throughout the country were present. Dr. Brashear was presented with numerous tokens of appreciation.

The eightieth birthday anniversary of Andrew Carnegie and the fifteenth anniversary of the founding of the Carnegie Institute of Technology at Pittsburgh were observed simultaneously Nov. 24 and 25. Prominent men in educational and industrial lines from all over the country were present. Mr. Carnegie sent a letter to A. A. Hamerschlag, in charge of the Carnegie Technical Schools, expressing his great satisfaction with the splendid work the schools are doing, and expressing the hope that he and Mrs. Carnegie would be in Pittsburgh next year when the annual exercises were held.

Paul R. Ramp, works manager, Quigley Machine & Foundry Company, Springfield, Mass., has resigned to become associated with the Elmwood Castings Company, Cincinnati, Ohio, as assistant to the president of that company.

Morton S. Newhall has become associated with the firm of Robert C. Lea & Co., dealers in pig iron, iron ore, coal and coke, 21 South Twelfth Street, Philadelphia, Pa.

William H. Tolhurst, founder of the Tolhurst Machine Works, Inc., Troy, N. Y., who retired from business some years ago, recently celebrated his second silver wedding.

H. G. Saylor, secretary of the Anglo-American Mill Company, Owensboro, Ky., manufacturer of flour mills, has resigned to take a similar position with the Larsen Ice Machine Company, Chicago. Marion E. Roselle, Chambersburg, Pa., has been selected to succeed him. The change is effective Jan. 1.

Herbert E. Herrod, formerly assistant commissioner of the National Metal Trades Association, has been appointed manager of the Hamilton Manufacturers' Association, Hamilton, Ohio.

P. H. Mynahan of Pittsburgh, formerly manager of the Louckes Iron & Steel Company, Roanoke, Va., is in Vancouver, B. C., engaged in the erection of a rolling mill for the Port Moody Steel Works Company, of which he has been appointed manager. He designed and erected the mill of the Southern Mfg. Company, Atlanta, Ga., as well as a number of plants in the Pittsburgh district.

Dwight F. Mallory of the T. H. Symington Company, which absorbed the Farlow Draft Gear Company, 1005 Maryland Trust Building, Baltimore, Md., is missing, not having been seen since he went duck shooting on the Susquehanna River, Nov. 19.

James H. Nutt, secretary of the Western Bar Iron Association, Youngstown, Ohio, has been made director of public safety of that city. He is also a member of the board of education.

H. Numato, engineer in charge of construction in the Imperial Steel Works, Japan, is a visitor to Baltimore.

L. Blaine Snow, who for about six years has been chief clerk in the St. Louis office of W. B. Weston, Western sales manager of the Carnegie Steel Company, Illinois Steel Company and Tennessee Coal, Iron & Railroad Company, has resigned to take a position in the East.

William Cairns, formerly president and general manager of the Parish & Bingham Company, Cleveland, Ohio, has become associated with the Detroit Pressed Steel Company, Detroit, Mich., maker of automobile frames and steel stampings, as general manager. H. J. Foster, for several years production manager of the Hydraulic Pressed Steel Company, Cleveland, has taken a similar position with the Detroit company. C. H. L. Flinterman, Detroit, retains the position of vice-president and active head.

Clarence H. Howard, president Commonwealth Steel Company, Granite City, Ill., with offices in St. Louis, gave a unique theater party on Monday, Nov. 29, buying out the entire house and inviting his plant force together with a number of others to attend as his guests. The Governor of Missouri and the Mayor of St. Louis were also guests.

New Cambria Steel Company Directors

At a meeting of the board of directors of the Cambria Steel Company, held in Philadelphia, Nov. 24, Herbert F. Black of Pittsburgh, J. Leonard Replogle, New York, and Arthur E. Newbold, Philadelphia, were elected directors. They succeeded Samuel T. Bodine, Theodore N. Ely and Childs Frick, the latter a son of Henry C. Frick. Messrs. Replogle and Newbold were made members of the executive committee.

Effingham B. Morris, who with Mr. Ely represented the Pennsylvania Railroad, maintained his connection as a director of the company after considerable pressure had been brought urging him to reconsider his intention of resigning. He has been a director for the last fifteen years, and his presence on the board is considered valuable.

The election of Arthur E. Newbold, member of the firm of Drexel & Co., the Philadelphia branch of the banking house of J. P. Morgan & Co., is taken as evidence that Drexel & Co.'s participation in the Replogle syndicate is more than that of mere banking agents.

Herbert F. Black is special agent of the Cambria Steel Company and has offices at Pittsburgh, being in charge of the buying and distribution of ore, coal, scrap and supplies. For a number of years he was assistant to D. G. Kerr when the latter had charge of raw materials for the Carnegie Steel Company. He became connected with the Cambria Steel Company about two years ago.

Crucible Steel Company's Officers

At a meeting of the board of directors of the Crucible Steel Company of America, held Nov. 23, the executive committee and officers were elected for the ensuing year. The executive committee consists of Herbert DuPuy, C. C. Ramsey, H. S. A. Stewart, H. D. W. English, George E. Shaw, George W. Crawford and John A. Sutton.

The officers are as follows: Herbert DuPuy, chairman executive committee; C. C. Ramsey, president; O. H. Wharton, assistant to the president; John A. Sutton, first vice-president; J. W. Dougherty, second vice-president; G. W. Sargent, third vice-president; H. A. Brown, fourth vice-president; George A. Turville, treasurer and secretary; N. W. Nolen, comptroller; A. A. H. Niebaum, assistant treasurer; H. F. Kress, assistant secretary and assistant treasurer; G. A. M. King, auditor.

The Jeffrey Mfg. Company, Columbus, Ohio, has opened a new branch office in the M. & M. Building, Milwaukee, Wis. This office will be in charge of A. Q. Dufour, whose long experience in the application of the Jeffrey products will enable him to be of great assistance to customers in solving their elevating, conveying and transmission problems.

The new mining building of the School of Mines of Pennsylvania State College, State College, Pa., was dedicated on Nov. 5. The museum of the school is being installed in the new quarters, which give also increased facilities for classroom and laboratory work. The School of Mines was established in 1884.

The Utah Iron & Steel Company has started up the rolling mill near Midvale, Utah, illustrated in THE IRON AGE of July 22. It has heating furnaces for utilizing scrap material and rolls for turning out bars, small shapes, etc., and has now under consideration the installation of an open-hearth furnace.

OBITUARY

Adolphe Greiner

Adolphe Greiner, managing director of the John Cockerill Works, the important steel and ordnance works of Belgium, at Seraing, near Liege, and president of the Iron and Steel Institute, who was reported seriously ill of enteric fever at the meeting of the Iron and Steel Institute, London, Sept. 23, died Nov. 20. It is generally understood that he refused to comply with German demands with regard to the operation of the works when the Germans gained control of that part of Belgium in the fall of 1914 and for a time at least was practically a prisoner in his own house. According to the report of

ADOLPHE GREINER

the council of the Institute, printed in its 1915 volume, he "has remained at his post, continually encouraging with his unfailing spirit the members of the staff of the Cockerill Company and his workmen, and organizing means for the alleviation of the distress of the large industrial population dependent on the company for employment."

Dr. Greiner's elevation to the presidency of the Institute was announced at its meeting in September, 1913, in Brussels, and he assumed office at the meeting in London, in May, 1914. His notable presidential address, having to do with coke ovens, coke oven gas and coke oven by-products, and with blast furnaces, blast furnace gas and slags, cements, bricks, etc., was reviewed at length in THE IRON AGE. The autumn meeting of the Institute, arranged to take place in Paris in September of 1914, did not, of course, transpire, and Dr. Greiner served but a short time, as the directing head of the Institute, "to emphasize its international character," as he phrased his explanation of his election to the office.

He was 71 years of age. Since 1887 he had been the managing director of the Cockerill Works, but his whole business life was devoted to this company, which he entered in his youth as a works chemist after training at Liège School of Mines. The company adopted the basic Bessemer process under his directorship. He was a pioneer in the utilization of blast furnace and coke oven gases for the generation of power in iron and steel works. He was president of the Central Committee of Industrial Labor of Belgium, president of the Geological and Mining Society of Belgian Engineers and an officer of the Legion of Honor. He was also past president of the Society of Engineers and of the Société d'Ingeneurs Sortis de l'Ecole Polytechnique. He held the Bessemer medal of the Institute and was the second foreigner on whom the Institute's presidency has been conferred, the other being Andrew Carnegie, who held the office from 1903 to 1905.

FREDERICK WARREN DODGE, president F. W. Dodge Company, died Nov. 10 at his home in New York City, aged 51 years. He was born in Melrose, Mass., and after some business experience founded the company in 1891 in Boston. In 1896 he formed a partnership with Clinton W. Sweet, publisher of the *Architectural Record*, *Record and Guide* and *Sweet's Catalogue*, transferring shortly afterward to New York the head office of the F. W. Dodge Company. The business of issuing daily building reports, as devised by Mr. Dodge, was rapidly extended to other cities throughout the country. In 1912 he purchased Mr. Sweet's interest in the company, which in the meantime had taken over all the other publications originally controlled by Mr. Sweet. For several years Mr. Dodge had been one of the largest publishers in the country in the architectural and building trade fields, several of his publications being issued in New York, Chicago, Pittsburgh and other cities. He leaves his widow but no children.

CHARLES EDWARD STAFFORD, for many years prominently identified with the steel industry, died of apoplexy Nov. 27 at Haverford, Pa., aged 61 years. For many years Mr. Stafford was chemist at the plant of the Pennsylvania Steel Company. He was widely known for his improvements in open-hearth furnace design. From 1885 until 1896 he was manager of the steel department of the Shoenberger Steel Company, Pittsburgh. He was also connected with the South Chicago plant of the Illinois Steel Company, and at one time was president of the Tidewater Steel Company, Thurlow, Pa.

GEORGE NASH, a retired importer of high-grade steel died Nov. 29 at his home in New York City, aged 62 years. He was born in England and came here 35 years ago. He retired four years ago. He leaves his widow and a daughter.

Decreasing Imports of Ferrosilicon

Imports of high grade ferrosilicon into the United States are growing less as the demand in Europe increases with advancing prices there. Demand in this country is as great as ever in the history of the steel industry. Prices here have also advanced decidedly. This alloy is next to ferromanganese in importance as a necessity in making steel. Government data show the following figures regarding recent imports:

	Gross Tons	
	1915	1914
July	234	623
August	86	1,113
September	142	355
Nine months ended Sept. 30	3,774	4,941

An analysis of these figures shows that the monthly imports for the first nine months of this year have averaged 419 tons per month, decreasing to an average of 154 tons per month for July, August and September, contrasted with 697 tons per month for these three months a year ago. For the second quarter of 1915, they were 1587 tons, or 529 tons per month. Imports for the fiscal year ended June 30, 1915, were 6608 tons, or 550 tons per month. The receipts are therefore at present 66 per cent to 75 per cent less than they were earlier in the year. This falling off is largely due to decreased available supply from Canada, large exports being made from that country to Europe.

Frank E. Smith, trustee in bankruptcy for the Premier Motor Manufacturing Company, Indianapolis, Ind., announces that the plant and good will have been sold to an out-of-town syndicate that is considering the construction of a larger plant. The syndicate is said to be headed by F. W. Woodruff, Joliet, Ill. The purchase price was $125,000.

Judicial Decisions

ABSTRACTED BY A. L. H. STREET

LEGALITY OF STRIKES AND EMPLOYERS' ASSOCIATIONS.—Although employers have equal rights with employees in the matter of organization to secure proper labor conditions, and although an individual employer, acting independently, is at liberty to refuse employment to any man or discharge any employee, with or without good cause, except where there is an express agreement with him to the contrary, it is an actionable wrong for employers to combine to blacklist men against whom they have no trade dispute or to coerce other employers to withhold employment from men who would otherwise be employed. Organized labor lawfully may strike for higher wages, shorter hours, or improved shop conditions, but a strike instituted merely to secure a closed shop is unlawful. (Massachusetts Supreme Judicial Court, Cornellier vs. Haverhill Shoe Manufacturers' Association, 109 Northeastern Reporter, 643.)

RIGHTS OF NON-RESIDENT CORPORATIONS.—A State law imposing conditions upon the right of a nonresident corporation to do business in the State or sue in its courts to enforce legal rights does not apply to interstate transactions, as where a traveling salesman solicits an order for goods, the order being forwarded to the home office of the company for acceptance or rejection. (Oklahoma Supreme Court, M. D. Wells Company vs. V. J. Howard & Co., 151 Pacific Reporter, 616.)

LIENS AGAINST ASSETS OF INSOLVENT COMPANIES.—A statute such as is in force in North Carolina, giving a lien against the assets of an insolvent corporation for wages due its employees, does not extend a lien to an independent contractor who has furnished teams and drivers for hauling structural steel and other material used by a corporation in constructing a bridge. (North Carolina Supreme Court, 86 Southeastern Reporter, 184.)

CLEANING MACHINERY IN MOTION.—It is negligence as a matter of law for a foreman in an industrial plant to undertake cleaning of moving machinery in violation of an established rule of his employer prohibiting it. (South Carolina Supreme Court, Newsom vs. F. W. Poe Mfg. Company, 86 Southeastern Reporter, 195.)

DAMAGES FOR WRONGFUL CONVERSION OF PERSONAL PROPERTY.—The damages recoverable for wrongfully converting to one's own use machinery or other personal property belonging to another are to be measured by the value of the property at the time of the conversion, with interest thereon from that time. (Oklahoma Supreme Court, Dunn vs. Modern Foundry & Machinery Company, 151 Pacific Reporter, 893.)

VALIDITY OF RESALE PRICE RESTRICTIONS.—Although a manufacturer of patented machines is unrestricted in his power to fix the original selling price, a contract binding a purchasing middleman to maintain certain retail prices is invalid. (United States District Court, Southern District of Ohio, Ford Motor Company vs. Union Motor Sales Company, 225 Federal Reporter, 373.)

MARGIN PURCHASE CONTRACTS.—Under a contract for sale of metal for future delivery, requiring the buyer to put up margins under the rules of the New York Metal Exchange, the seller is not entitled to recover damages as for anticipatory breach of the contract merely because the buyer has given notice that the contract is regarded as no longer effective and demanded return of margins deposited, if the seller, in response to such notice, refused to cancel the contract and notified the buyer that the agreement would be regarded as still in force. This is especially so where it appears that the contract is afterward terminated by the seller for failure of the buyer to post further margins. Where three independent contracts were made between the same parties for separate deliveries of tin in July, August and September respectively the buyer could not be regarded in default as to the August and September contracts, if sufficient margins were posted to cover them, although he may have been in default in refusing to make an additional deposit to cover margins on the July contract. And when it appears from the terms of such contracts that it was mutually agreed that each contract should stand alone, the seller cannot rely upon a custom of the Exchange authorizing retention of margins by the seller until fulfillment of all contracts pending between the parties, for a custom can never affect express agreements at variance with it. (New York Supreme Court, Vogelstein vs. Pope Metals Company, 155 New York Supplement, 128.)

OPINIONS AND MISREPRESENTATIONS DISTINGUISHED.—The Washington Supreme Court notes that a statement made by a salesman to induce a sale, concerning the merits of machinery sold, must be more than the expression of mere opinion, and holds that a statement made by the seller of machinery that it would operate at a specified saving above the cost of operating an old machine to be turned in by the buyer in trade was not actionable as a warranty. (Carver-Shadbolt Company vs. Loch, 151 Pacific Reporter, 787.)

DUTY TO WARN EMPLOYEE AGAINST DANGERS.—A manufacturing company cannot be regarded as having been negligent toward an operator of a freight elevator in its plant on the theory of having given him insufficient instructions how to operate elevator, where after some instruction he ran it for about thirty days, and the cause of his injury was unexplained starting of the elevator. (Michigan Supreme Court, Guido vs. Detroit Stove Works, 154 Northwestern Reporter, 128.)

RESERVING TITLE TO GOODS SOLD RETAILER.—A manufacturer, in selling goods to a retail dealer, may validly reserve title to the goods, subject to the latter's right to sell them in due course of trade and account for the proceeds until the agreed price should be paid the manufacturer. A dealer who signs an order containing such a reservation of title cannot afterward assert ignorance of the provision, in the absence of a showing that he was fraudulently prevented from ascertaining the existence of the clause in the order. (Michigan Supreme Court, Mishawaka Woolen Mfg. Company vs. Stanton, 154 Northwestern Reporter, 48.)

MACHINERY AS PART OF REAL ESTATE.—When an owner of land constructs a manufacturing establishment on it, affixing it to the real estate in a permanent way, the machinery becomes a part of the real estate and ceases to be personal property. The same conversion of character occurs when a lessee of land constructs a manufacturing plant on it and afterward becomes owner of the real estate. (Arkansas Supreme Court, W. B. Thompson & Co. vs. Lewis, 179 Southwestern Reporter, 343.)

MINORS AND WORKMEN'S COMPENSATION.—If a minor is old enough to be permitted by law to work in a given establishment, but not old enough to be lawfully employed in certain hazardous occupations, the fact that he was injured while engaged in a hazardous occupation will not entitle him to disregard the Wisconsin workmen's compensation act, and sue for damages. (Wisconsin Supreme Court, Foth vs. Macomber & Whyte Rope Company, 154 Northwestern Reporter, 369.)

MEASURE OF DAMAGES FOR BREACH OF CONTRACT.—Ordinarily, the damages recoverable for breach of a contract to sell and deliver castings is the excess of the cost of procuring substitutes of the same kind above the price at which defendant agreed to sell, regardless of whether plaintiff buyer actually bought substitutes or not. (Michigan Supreme Court, Rockford Malleable Iron Works vs. Tilden, 154 Northwestern Reporter, 35.)

MISROUTING OF FREIGHT BY CARRIER.—"This court has certainly adopted the doctrine that if a common carrier contracts to carry freight by a specified route and sends the goods by another route, it becomes liable as an insurer for any injury which may result by reason of its unauthorized act." (Wisconsin Supreme Court, Rosenthal vs. Chicago & Northwestern Railway Company, 154 Northwestern Reporter, 366.)

Pittsburgh and Nearby Districts

Alex Laughlin & Co., engineers and contractors, Pittsburgh, are acting as consulting engineers for the Steel Company of Canada, which is increasing its open-hearth steel capacity, and have placed orders for a 125-ton ladle crane and a 40-ton and a 10-ton traveling crane with the Shaw Electric Crane Company.

The Ward Nail Company, Struthers, Ohio, is adding nine cut nail machines and making other extensions to its plant.

The Mahoning & Shenango Railway Light Company will build a large power plant at Youngstown, Ohio. Stone & Webster, who are the general contractors, are erecting foundations for a 20,000-hp. turbine. The company will be in the market for a large quantity of electrical equipment.

The Youngstown Car Company, Youngstown, Ohio, will shortly place contracts for shop buildings to replace those destroyed by fire some time ago, and will also be in the market for considerable new equipment.

The National Pump & Machine Company, with a capital stock of $2,545,000, has been incorporated under the laws of Pennsylvania by W. V. Miller, R. Huyck, C. H. Lay, S. R. Ball and F. D. Williams, all of Oil City, Pa., to manufacture pumps, engines, compressors, tools, fittings and machine supplies. Most of the stock is held by the National Transit Company, Oil City. C. H. Lay is treasurer of the new company.

The Simplex Mfg. Company, Meadville, Crawford County, Pa., with a capital stock of $10,000, has been incorporated by L. L. Lord, Otto Kohler, W. S. McGunnegel, Charles Veith, Charles Fahr, C. S. Burwell, P. W. Kaufman, John E. Reynolds, all of Meadville, and H. F. Giele, of Cleveland, Ohio, to manufacture automobile supplies and parts for all kinds of vehicles.

The board of control of East Liverpool, Ohio, has awarded the contract for the superstructures for the new pumping station and filter plant to the Pitt Construction Company, Pittsburgh, which was the lowest bidder on the work at $52,900.

East Youngstown, Ohio, is advertising for bids on a complete waterworks system in accordance with plans and specifications of Chester & Fleming, engineers, Pittsburgh. Bonds to the amount of $165,000 have been sold for this construction. The work consists of a 1,000,000-gal. mechanical filter plant, gas-engine-driven pumping station, cast-iron distributing system, steel storage tank, tools and appurtenances.

The Youngstown Sheet & Tube Company, Youngstown, Ohio, has purchased from the Baldwin Locomotive Works one 17 x 20-in. 50-ton narrow-gage four-wheel saddle tank locomotive for use in connection with the extension to its open-hearth plant.

The report that the Andrews & Hitchcock Iron Company, Youngstown, Ohio, will build an open-hearth steel plant is incorrect, the company not having officially considered the proposition. No. 2 blast furnace of this company is making about 400 tons of foundry iron per day, while No. 1 stack is idle, being relined, but is expected to go in about Dec. 15 and to make about 350 tons per day. The latter furnace and Niles stack of the Carnegie Steel Company at Niles, Ohio, are now the only two idle furnaces in the Mahoning valley.

The Ralston Steel Car Company, Columbus, Ohio, is considering the erection of a new works at Carnegie, Wis., near the plant of the Minnesota Steel Company, Duluth. If the plant is built, plates and other materials entering into the manufacture of steel cars and steel underframes will be secured from the Minnesota Company.

The Clark Company, recently organized at West Newton, Pa., with a capital of $25,000, for the manufacture of pipe fittings, states that its plant is ready for operation and that it has bought all the equipment needed. W. E. Clark is president; O. E. Horn, vice-president; J. C. McInnes, treasurer, and R. M. Clark, secretary.

The Westinghouse Machine Company, East Pittsburgh, is filling contracts for approximately $1,000,000 worth of marine engine machinery. These contracts involve equipment for two Swedish battleships, one 10,000-hp. passenger steamer for the Matson Navigation Company, San Francisco, and two freight steamers being constructed by the Chester Shipbuilding Company, Chester, Pa. Marine turbines, mechanical reduction gears, steam condensers and other engine-room equipment will also be furnished by the company.

The American Car & Ship Hardware Mfg. Company, manufacturer of brass and bronze bushings and bearings, castings, aluminum, etc., New Castle, Pa., is making large additions to its present plant in order to take care of the greatly increased demand. The additions will almost double the present output. P. J. Flaherty, general manager, when asked if the increased orders were caused by the war, stated that they absolutely were not, and that the company had been offered several war contracts, but had refused them all.

Benzol Plant for Youngstown Sheet

Announcement was made late last week by President James A. Campbell that the Youngstown Sheet & Tube Company, Youngstown, Ohio, will erect a benzol plant in connection with its 204 Koppers by-product ovens now in course of construction. It will be erected by the Semet-Solvay Company, Syracuse, N. Y., will be designed to recover benzol, toluol, xylol, and solvent naphthas, in addition to the ordinary recovery process and will have capacity sufficient to take care of all the gas produced by the new battery of ovens. It will be one of the largest by-product recovery installations in the country, carrying the process to the farthest limit which has been found profitable and will cost about $450,000. The coke-screening and coke-handling machinery will be installed by the Robins Conveying Belt Company, New York, and will cost about $100,000. The latter company is closely affiliated with the Republic Rubber Company, Youngstown, which will furnish the huge belt systems for carrying the coke back and forth. Both contracts are to be completed by March 1, 1916, at which time it is expected that the new oven plant will be ready for operation. They constitute one of the important links in the long chain of extensions, which, when completed, will make the Youngstown Sheet & Tube Company one of the most thoroughly self-contained plants in the world.

New Ownership of Temple Furnace

H. H. Adams, of New York, and others have practically completed negotiations for the purchase of the blast furnace of the Temple Iron Company at Temple near Reading, Pa., and Albert Broden, for many years superintendent of the Reading Iron Company's blast furnaces, has given up that connection to have charge of the property of the new company, in which he will have an interest. Temple furnace has long been the property of the anthracite railroads, which were interested also in the Temple Coal Company. The furnace is 75 x 15 ft. and has a yearly capacity of 60,000 tons. After having been inactive for months it was started up in October, but had been operated but a short time when it was put out for repairs.

The Pittsburgh Iron & Steel Foundries Company, Midland, Pa., whose products bear the brand of Adamite, announces that it has increased its capacity by the addition of a new open-hearth furnace and other equipment and is in better position to make prompt deliveries on orders. The company states that Adamite rolls continue to make remarkable records in the various mills of the United States and Canada as to tonnages produced and diminution of time lost for roll changes.

A San Francisco dispatch states that contracts aggregating $2,850,000 have been awarded to the Union Iron Works for the construction of three vessels, work on which is to be begun at once. Two of the ships are for the Atlantic & Gulf Refining Company, and the other is for Elkstrom & Co.

Machinery Markets and News of the Works

NOTABLE RAILROAD LIST

Great Northern Actively in the Market

Domestic Demand Continues to Grow and Tool Builders Face Problem in Caring for Customers—Strike Situation Improved

The difficulty of obtaining machine tools is exemplified by the action of the Great Northern Railway Company in giving publicity to a long list of tools and shop equipment for which it is in the market. From every side comes reiteration of the reports that domestic buyers are seeking machines. Chicago, for instance, finds that the need of equipment for the production of products normal to our domestic trade is assuming proportions no longer negligible to the builders of machinery, and that special efforts are being made to take care of customers. The problem is one which can only be solved with difficulty, as contracts now on the books call for heavy deliveries for some time to come and, in many cases, these will be delayed by the recent strikes. More men returned to work in Cincinnati last week, and altogether the situation is better in that city and at Hamilton, though at Dayton there is no change. Manufacturers are exercising more care to insure themselves against loss in the matter of orders from the munitions makers.

In New York and elsewhere demand is growing for large lathes suitable for making big guns. These machines range in swing from 45 to 60 in., and between centers from 25 to 35 ft.

Interesting details are given in the New England market of the formation of the Maxim Munitions Corporation, which is to take over the inventions of Hudson Maxim.

The Poole Engineering & Machine Company, Woodberry, Md., has received another large war order for shells and rapid-fire guns valued at $12,000,000.

A large percentage of the activity in Detroit continues to come from the automobile and allied industries, but all of the metal-working trades are buying also. The Searight-Downs Mfg. Company has been organized in Detroit to do a general machinery business. Cleveland had a good week, one dealer of that city having booked an order for $40,000 worth of machinery for an Ohio maker of automobile parts and accessories. The Ajax Mfg. Company, Cleveland, maker of forging machinery, is having plans prepared for an extension to its plant. A new factory will be built by the Northern Blower Company, Cleveland.

The Allis-Chalmers Mfg. Company, Milwaukee, has taken an order from the United States Steel Corporation for gas engines to be installed at the Gary plant of the corporation at a cost of $1,500,000.

New manufacturing projects and public service works are numerous in the Central South, and November is accounted the best month of the year in that section. St. Louis is suffering from the difficulty of making deliveries, and second-hand machines there have been taken up eagerly.

Conditions on the Pacific coast point to a general resumption of activity in every line. Railroad, as well as shipbuilding shops are busy, and mining and smelting operations are increasing. Texas is feeling a good demand for drilling and pumping machinery from new oil fields near San Antonio.

Metal-working plants are working at full pressure throughout Canada, and would be busier were it not for the scarcity of labor.

Machine-tool builders, like many others, are suffering from the inadequate supply of high-speed steel for which high prices are paid.

New York

NEW YORK, Dec. 1, 1915.

The aggregate of sales has dropped off a little, but only for the reason that the supply of machine tools is not equal to the demand. Domestic inquiries continue to come out in growing proportion. The trade is giving more and more attention to the question of eliminating risk. Careful phrasing of contracts enters as much into this question as does securing substantial deposits at the time of sale. Delayed deliveries occasioned by labor troubles are keenly felt by buyers and sellers. Purchasers have for the most part taken a liberal attitude when deliveries have been delayed, and there have been but few cancellations. Some of the large dealers say they are highly gratified by the stand their customers have taken, and it can be said that tool builders are appreciative also.

There is a growing demand for large engine lathes, to be used in the making of big guns. The sizes called for range from 45 to 60-in. swing, and 25 to 35-ft. between centers.

Russian agents continue to be large purchasers, freely taking second-hand machinery when they can find it. Inquiry for presses such as are used in shell making is heavy.

The New York & Hagerstown Metal Stamping Company is inquiring for drawing presses having a throw of from 6 to 15 in. for completing the manufacture of brass shells drawn from 3/16-in. metal. Frederick Sellar is president of the company and may be addressed care of W. R. Hughes, 110 West Fortieth Street, New York City.

The scarcity of high-speed tool steel is hampering some of the machine-tool builders. They have lately paid $2.80 to $3.05 per lb., depending on the tungsten content, for such small quantities as they can find.

The Driggs-Seabury Ordnance Company has exercised an option to buy the majority of stock of the Savage Arms Company, Utica. The option was originally held by the Bradley Construction Company, but was relinquished about ten days ago. The reason the Bradley interests failed to take up the shares has not been learned, and officers of the Savage Company yesterday declined to comment on the transaction. Both the Driggs-Seabury and Savage companies have received substantial orders from the Allies. It is supposed that the Savage Company will take over a part of the Driggs-Seabury contracts for rifles.

The Penna Equipment Company, Coleman Building, Philadelphia, Pa., is seeking a 1000-ton hydraulic forging press.

The Great Northern Railway Company, F. A. Bushnell, purchasing agent, St. Paul, Minn., is in the market for the following tools, all driven by 250-volt direct-current motors:

One 16-in. engine lathe with 12-ft. bed, head stock double geared with heavy bearings; spindle to have 1 5/16 in. hole; tailstock with taper turning adjustment; carriage to have automatic feeds in all directions; complete with steady rest, tools one independent four-jawed Cushman chuck fitted to spindle, and one 5-hp. motor for forward and back speeds.

One 28-in. swing upright drill press with revolving table (not geared), with tools and 2-hp. motor belted to pulley.

One pipe-threading machine, complete with adjustable dies to thread from ¼-in. to 3-in.

One pipe-threading machine with adjustable dies to thread from 3½-in. to 10-in. inclusive, complete with tools and 3- and 5-hp. motors, mounted on machine.

One 24-in. stroke shaping machine without traveling head, complete with tools and 5-hp. motor mounted on machine.

One square base emery floor grinding machine, distance between wheels about 33 in., diameter of wheels 18 in., width of

face 2 in., diameter of spindle for wheels not less than 2 in., base provided with doors; complete with emery wheels and tools. To be fitted with taper safety collars with bevel of ½ in. per ft. and safety guard over wheels; 5-hp. motor mounted on frame.

One 48-in. x 6-in. cast-iron grinding stone trough, mounted on wheels, complete with grinding stone and 1-hp. motor.

One 1500-lb. single frame steam hammer with 12-in. diameter cylinder, 33-in. stroke, complete with tools and dies; steam cylinder strength for 125 lb. per sq. in. pressure.

Two 54 x 54 x 24-in. square base, steel stationary blast forges, complete with tuyeres and blast grates for heavy work and equipped with overhead hood and two 1-hp. motor-driven blowers.

One 18-in. extra heavy vertical wood boring machine with adjustable table and angle-boring attachment, capacity to bore 2-in. holes; complete with tools and one 3-hp. motor.

One iron box frame rip-saw table, complete with raising and bevel-cutting attachment, to be fitted with 30-in. saw; complete with tools and one 12-hp. motor.

One 30-in. engine lathe with 18-ft. bed, headstock double-geared with heavy bearings; hollow spindle, tailstock adjustment for turning taper; carriage to have automatic feeds in all directions. Machine complete with full train of gearing for cutting threads; two steady rests, one standard size and the other to take 20-in. tools for lathe and one 20-in. independent four-jawed Cushman chuck; equipped machine with 15-hp. motor. Quotation should give maximum clearance between centers.

One half universal radial drilling machine to drill 2-in. holes. To have horizontal range of 5 ft. center of column to extreme outward position of drillhead. Machine to have sole plate with slotted spaces for bolting large work, and a side extension on which to mount a universal table. Machine to be complete with tools and one 7½-hp. motor of 1200 r.p.m.

One 30-in. x 30-in. x 8-ft. heavy bed planing machine with one head on cross rail, complete with planer chuck having graduated round swivel base and necessary tools, and one 7½-hp. motor. Quotation should give maximum opening and length of jaw.

One 250-ton hydrostatic wheel press, with two pumps. Distance between bars 78 in., between resistance posts 7 ft. 6 in. Machine complete with tools and one 7½-hp. motor of not over 800 r.p.m.

One reversible pneumatic air drill for drilling 2½-in. and tapping 2-in. holes.

One 36-in. bandsaw with tension release, guides, tipping table and tools; equipped with 4-hp. motor.

One 16-in. hand-feed planing and joining machine, with safety cylinders; equipped with 5-hp. motor. Complete with tools.

One single-ended geared punching machine with 26-in. throat; with architectural jaw; fitted with two sets of punches, varying by sixteenths from ⅜ to 1 in., two pair of plate shears and one pair of bar shears with steel holders. Machine to punch 1-in. hole through 1-in. plate. Equipped with 7½-hp. motor.

One bolt cutter to thread bolts from ⅜ to 3 in., complete with wrenches, tap chuck, stop die and United States standard dies and taps varying by sixteenths from ⅜ in. to ⅝ in. and by eighths from ⅝ in. to 2 in., and by quarters from 2 to 3 in. Complete with wrenches and one 5-hp. motor, speed 1200 to 1200 r.p.m.

One 11-in. x 12-in. simple, horizontal, automatic, high-speed, inclosed type engine, direct-connected with 60-kw. generator, speed about 275 r.p.m., steam 135 lb. at throttle. Quote prices on single valve and non-releasing Corliss valve engines.

One 60-kw. compound-wound generator with inter-poles, etc.

One two-panel slate switchboard.

Generator panels, fully equipped.

The increased demand on the Ansco Company, Binghamton, N. Y., manufacturer of photographic apparatus, cameras, films, etc., has made it necessary to increase its capacity, and contract for the engineering and construction of extensions and improvements to its power plant has been awarded to the J. G. White Engineering Corporation, New York City.

The Raritan Copper Works, Perth Amboy, N. J., copper refiners, is erecting an addition to one of its casting buildings to give additional furnace capacity. It will be hollow tile and steel. The equipment to be ordered will consist of one refining furnace, one casting machine and two 15-ton electric traveling cranes. N. W. Pierce is purchasing agent.

The Fold-Easy House Mfg. Corporation, Elmira, N. Y., has been incorporated with a capital stock of $250,000 by Mayne C. P. Parker, Howard E. Baker and W. A. Painter, 361 Maple Avenue, Elmira, to manufacture "knock down" furniture, sporting goods, etc. It is manufacturing its lines at McClure, Pa., where it has a factory of 35,000 sq. ft. floor space; but on account of increased business it will locate an additional factory at Elmira, where it has bought the Diven Mfg. Company, manufacturer of sectional bookcases, etc., and land adjoining it, where it will erect additional buildings next spring. Its general offices will be located in Elmira. Mayne C. P. Parker is president; W. A. Painter vice-president; H. E. Baker treasurer, and J. I. Kearns secretary.

The Niagara Motor Boat Company, North Tonawanda, N. Y., has increased its capital stock from $25,000 to $50,000 to take care of an extension in its business. It recently built an addition to its plant providing 5000 sq. ft. of floor space. Covert Robertson is president; Frederick Robertson, vice-president, and James Robertson, secretary.

The M. C. Clausen Architectural Iron Company, Tivoli Street, Albany, N. Y., has increased its capital stock from $20,000 to $35,000 to provide additional manufacturing space, equipment and stock. Morgan D. Griswold is treasurer.

The Linde Air Products Company, 30 East Forty-second Street, New York City, has awarded the contract to H. D. Best Company, 52 Vanderbilt Avenue, New York, for the construction of a one-story brick service plant, 74 x 103 ft., to be erected at Driggs Avenue, near Tenth Street, Brooklyn.

The Norwick Wire Basket Company, Norwick, N. Y., has increased its capital stock from $25,000 to $50,000. It has taken additional manufacturing space to provide for its increased business temporarily but is securing options and drawing plans for a building which it will erect. J. B. Turner is president and F. V. Fernalld is manager.

The DeWitt, Boag Company, Hornell, N. Y., will shortly let contract for construction of a two-story building, 50 x 80 ft. in size.

The Corrugated Nib Toe-Calk Company, New Rochelle, N. Y., has been incorporated with a capital stock of $100,000 to manufacture toe-calks and patent devices for horseshoes, blacksmith's equipment, etc. H. O. Kilbourne, 97 Hamilton Avenue, Englewood, N. J.; F. White, 1317 Plimpton Avenue, Highbridge, and H. Osswald, Greenlawn, L. I., are the incorporators.

The Keuka Fiber Board Corporation, Penn Yan, N. Y., has filed articles of incorporation with a capitalization of $50,000 and will establish a plant for the manufacture of paper and fiber board. W. B. Ward, Penn Yan; I. R. Koens, Huntington Mills, Pa., and C. Marvin, Elmira, are the incorporators.

Articles of incorporation have been filed by the Utica Assets Realization Corporation, Utica, N. Y., capitalized at $150,000, to manufacture hardware, etc. The incorporators are C. A. Miller, C. B. Mason, Utica, and J. D. Judson, Vernon, N. Y.

The Fibre Corporation, Lockport, N. Y., is having plans prepared for a factory to be erected next spring to replace one recently destroyed by fire.

The Bausch & Lomb Company, manufacturer of optical and astronomical instruments, Rochester, N. Y., has let contracts for the erection of an additional factory, 70 x 110 ft., one story.

The Pierce-Arrow Motor Car Company, Buffalo, has let contract for erection of a laboratory and experimental building, 50 x 90 ft., two stories, at its plant at Elmwood Avenue and New York Central Railroad Belt Line.

The Buffalo General Electric Company, Buffalo, has plans in prepartion for an electric power generating plant, steam-driven, which it will construct on the Niagara River, just below the city. The capacity will be 100,000 hp. and is estimated to cost $1,500,000 with equipment. Charles R. Huntley is president.

The Hartman & Son Piano Company, Buffalo, has filed certificates of incorporation and will establish a plant for the manufacture of pianos and musical instruments. The directors are Joseph M. Edelson, Francis William Russell and Bertram L. Marks, all of New York City.

The Ferguson Steel & Iron Company, Buffalo, is completing a structural steel addition to its fabricating plant at Bailey Avenue and the New York Central Railroad.

Philadelphia

PHILADELPHIA, PA., Nov. 29, 1915.

The Bateman Mfg. Company, Grenloch, N. J., manufacturer of garden tools, etc., which employs 600 men, went on a six-day schedule Nov. 29.

It is reported that 200 workmen have been added to the force of the Remington Arms Company, Eddystone, and that the total number now on its payroll is near the 2000 mark.

The National Rubber Company, Pottstown, Pa., will build a two-story reinforced concrete and brick factory, 124 x 170 ft., and a powerhouse, 47 x 120 ft., to be added to its plant.

The Fred A. Havens Company, 845 North Nineteenth Street, Philadelphia, has a contract for making extensive alterations and additions to the plant of the Harlan & Hollingsworth Company, at Wilmington. The work includes the

erection of new stacks on piling and concrete foundations, the construction of a 100-ton traveling crane, a paint shop and riggers' loft of reinforced concrete and brick construction, and general repairs to the boiler shop.

The Tioga Machine Company, 2027 Estaugh Street, Philadelphia, recently incorporated, manufactures sheet metal dies and does general machine shop work. It does not make hatchets, etc., as has been reported. E. Walt Havens is president and C. M. Ayars is treasurer and general manager.

The Schneider-Bowman Company, Frankford Avenue and Vandyke Street, Philadelphia, Pa., will receive bids for an addition to its foundry, 18 x 76 ft., two stories, of brick construction. Stearns & Castor, Stephen Girard Building, are the architects.

G. F. Durand & Sons, 1200 Chestnut Street, Philadelphia, have drawn plans for a seven-story hospital and a one-story powerhouse. John McShain, 1610 North Street, Philadelphia, is the contractor and will erect the building for the Misericordia Hospital, Merion, Pa.

William E. Cooper, 712 North Third Street, Philadelphia, has awarded contract to the Joseph Levin Company, 1130 South Sixth Street, for the construction of a one and two-story brick cooper shop and boilerhouse to be erected at 326 Brown Street at a cost of about $6,000. They will be 40 x 80 and 16 x 52 ft.

Harry T. Saunders, 31 South Eighteenth Street, Philadelphia, has awarded contract to Herman Voight, Twenty-eighth Street and Girard Avenue, for the construction of a one-story brick machine shop to be erected at 2215 Race Street at a cost of about $4,500.

The National Rubber Company, Pottstown, Pa., has received bids through its engineer, M. N. Schumaker, Union Building, Newark, N. J., for the construction of a reinforced concrete factory, two stories, 134 x 170 ft., and a one-story powerhouse, 27 x 120 ft.

The J. B. Coles & Sons Company, Twelfth Street and Kaighn Avenue, Camden, N. J., has had plans drawn for the construction of a two-story brick wood-working plant, 80 x 140 ft., to be erected at Front and Camac streets.

The New Jersey State Hospital, Trenton, N. J., will erect one-story brick and steel additions, 44 x 71 ft., to its hospital, and 24 ft. sq., to its powerhouse. Plans call for the installation of four 264-hp. boilers. George S. Drew, Trenton, is State architect.

The Atlas Ball Company, Second Street and Glenwood Avenue, Philadelphia, has taken out permit for factory alterations to cost about $3,400. The William Steele & Sons Company, 1600 Arch Street, is the contractor.

The Autocar Company, Ardmore, Pa., is having plans drawn by Stearns & Castor, Stephen Girard Building, Philadelphia, for a three-story brick and concrete building, 150 x 300 ft., to be added to its motor vehicle plant, which will enable it to double its output. It states that its business has increased 70 per cent over the first ten months of last year and is entirely confined to domestic orders. Walter W. Norton is vice-president and production manager.

Baltimore

BALTIMORE, MD., Nov. 29, 1915.

Two additional buildings will be constructed at the plant of the Baltimore Tube Company, Wicomico and Ostend streets, Baltimore. Each will be one-story, of brick and concrete construction; one, 38 x 177 ft., and the other 31 x 44. They will cost about $12,000.

A large building at Sixteenth Street and Second Avenue, Canton, Md., is being fitted up as a galvanizing plant for the Refractory Zinc Ore Treatment Company, 3 William Street, New York. A. W. Hahn will be in charge.

McLaughlin Brothers, Inc., 915 Bolton Street, Baltimore, has been awarded a contract for the construction of a 76 x 124 ft., one-story, brick addition to the plant of the Baltimore Buggy Top Company, automobile repairers, 107 West Mount Royal Avenue.

Another large war order has been received by the Poole Engineering & Machine Company, Woodberry, Md. The order is said to be for over $12,000,000 worth of shells and 1-lb. rapid-fire guns.

A sawmill which will cost about $45,000 is planned at Curtis Bay, Md., by the Baltimore & Ohio Railroad Company. The plans have been drawn by M. A. Long, architect for the company. It will be 36 x 420 ft., but no announcement as to its use has been made.

A one-story 30 x 112 ft. addition will be constructed to the Mount Clare shops of the Baltimore & Ohio Railroad Company, Pratt and Poppleton streets, Baltimore, to cost about $4,000.

The Hess Steel Company has secured property at Loney's Lane and Biddle Street, Baltimore, for its proposed plant. Dietrich Brothers, Pleasant and Davis streets, Baltimore, have received the general contract for the three steel buildings which will be erected. They will be 240 x 260 ft., 60 x 80 ft. and 60 x 120 ft.

The German-American Car Company, Chicago, of which Max Epstein is president, is considering the construction of car works at Wagner's Point, Md.

Plans for the establishment of a box factory at South Hill, Va., are being made by G. A. Smith, president, South Hill Mfg. Company.

Prices on boilers and engines for a sawmill are being sought by C. S. Barnes, Keysville, Va.

A brick foundry building which will cost about $5,000 will be erected by the Norfolk Structural Steel Company, 400 Nivison Street, Norfolk, Va.

A garage 53 x 107 ft. will be built at Ninth and French streets, Wilmington, Del., by S. L. McKee, at a cost of about $18,000.

Plans are being prepared for the Du Pont Powder Company, Wilmington, Del., for an experimental mechanical laboratory, 90 x 110 ft.

The plant of the old Diamond State Steel Company, Wilmington, Del., which will begin operations about the first of the year, will turn out steel billets and steel bars. No name for the new company has been announced. The plant is also equipped to make horseshoes.

Several cranes will be added to the shipyard equipment of the Standard Fertilizer Company, Curtis Bay, Md.

Announcement has been made that Hill & Mount, lumber dealers, Newark, Del., will establish a box-assembling plant in Baltimore. They have received a large order for boxes for the shipment of munitions from the Bartlett-Hayward Company and have leased a building with 35,000 sq. ft. floor space.

An addition, to cost $100,000, will be erected at the plant of the Maryland Steel Company, Sparrows Point, Md.

New England

BOSTON, MASS., Nov. 29, 1915.

Only in Worcester, Mass., does the strike situation among machine shops remain as a serious factor. In that city it is slowly improving, largely through the successful efforts of the employers to obtain help elsewhere. In the other cities the situation has become so nearly normal that the manufacturers are not worrying about the few men still out. Agitation continues, but the strike fever seems to have departed.

The worst situation confronting factories is the blockade in freight, which has become serious in several places in spite of efforts of the railroads and express companies. To cite one instance, freight yards at Waterbury, Conn., are handling from 4000 to 5000 cars each week and four additional tracks have been built to lessen the congestion. In this city the express business has doubled in volume in three months and more than 2000 pieces are handled daily.

New England is sprouting new buildings and plants everywhere, and the demand for workers is becoming so great that every large city is finding itself competing for labor with other distant places through the activities of the employment agents of the larger companies who are roaming from city to city seeking men and offering previously unheard-of inducements.

It took only five weeks to erect the assembly building turned over to the Bullard Machine Tool Company, Bridgeport, Conn., this week by the contractors. The structure is of brick, 28 x 180 ft., two stories, with saw-tooth roof.

The Maxim Munitions Corporation, Equitable Building, New York City, as recently reported, has been formed to take over inventions of Hudson Maxim in aerial torpedoes, bomb-throwing devices, aeroplane guns, range-finding instruments, etc. In addition it acquires the right to all Mr. Maxim's future inventions in ordnance. It is manufacturing automatic machine guns, and has acquired the right to the Brown air-cooled shoulder machine rifle. Hudson Maxim is president; Edward H. Beckert is general manager; Laurence Angell, assistant general manager; John Hamilton Brown is consulting engineer; Edwin B. Hotchkiss, formerly superintendent of gun manufacturing firm of Henri Pieper, Liege, Belgium, and later general manager of Ad Janssens of Brussels and Paris, is chief engineer. J. S. Conradi, for five years manager of Vickers Sons & Maxim, London, is supervising engineer and M. H. Haysler will also act as consulting and supervising engineer. Louis W. Jordan, formerly master mechanic of the Birmingham Small Arms Company, Birmingham, England, will act in the same capacity for this company. The corporation has purchased a plant at New Haven on the New

York, New Haven & Hartford Railroad. The property covers about six acres and the buildings are equipped with power and shafting arrangements and are to a considerable extent already equipped with machinery. It has acquired all the outstanding stock of the M. Seward & Sons Company, New Haven, Conn., one of the old established drop-forging plants of New England, the company having been in business for some twenty years. The plant will be used in conjunction with the manufacture of automatic machine guns.

The Evans Stamping & Plating Company, Taunton, Mass., is asking bids on a foundry building.

The Manhasset Mfg. Company, Putnam, Conn., is to build at once a two-story factory, 120 x 180 ft., which will double the capacity of the plant.

The Wright Wire Company, Worcester and Palmer, Mass., has let a contract for an addition to the wire rope department at its Palmer plant, to be of brick, 50 x 160 ft., three stories.

It is reported that the Charles W. Morse interests of New York are negotiating for the purchase of the old McDonald Ship Yards, the Sutton Spar Yards, the old Sand Mill property and the Allen Spool & Printing property at Mystic, Conn., to be used as a shipbuilding plant.

The Benson Mfg. Company, Hartford, Conn., has been incorporated with authorized capital of $50,000. It will begin business with $25,000 and will manufacture safety cranks for gasoline engines, and other appliances. The incorporators are Lawrence Benson, Lewis B. Holbrook and Charles R. Hale of Hartford.

The American Chain Company, Bridgeport, Conn., is having plans drawn for an addition to its plant.

The American Graphophone Company, Bridgeport, Conn., is contemplating the erection of another large concrete building which will adjoin the five-story addition now under construction.

The Bridgeport Malleable Iron Works, Bridgeport, Conn., is replacing a small building with a brick structure designed to carry the weight of large traveling cranes.

At a meeting of the stockholders of the Trumbull Motor Car Company, Bridgeport, Conn., held Nov. 23, it was voted to petition the Superior Court to appoint a receiver to wind up the affairs of the company. It was incorporated for $300,000 and was supposed to be doing a satisfactory business, but the loss of an expected large foreign business due to the war and the death of the company's president, Isaac B. Trumbull, who was lost on the Lusitania, probably had much to do with the decision of the stockholders. All the officials of the company are connected with the Connecticut Electric Company, the two companies jointly occupying the same plant, and it is supposed that the purpose is to eliminate one of the organizations. Judge Edward K. Nicholson was appointed receiver by the Superior Court.

A new firm, C. A. Danberg & Co., will build a brass foundry on Stanley Street, New Britain, Conn.

The Boston Steel & Mfg. Company, Boston, Mass., has been incorporated with authorized capital of $10,000 by C. H. Hanson, president; C. Lowell Hanson, treasurer, and R. E. Hanson.

H. H. Kelley Company, Malden, Mass., is building a factory, 40 x 120 ft., two stories, and a boilerhouse.

Nelson Blower & Furnace Company has been incorporated at Boston, Mass., by A. H. Nelson, president; William B. Marshall, treasurer, and F. Batchelder. The authorized capital is $50,000.

The Shore Line Electric Railway has let the contract for a powerhouse, 45 x 80 ft., to be built at New London, Conn.

Chicago

CHICAGO, ILL., Nov. 29, 1915.

The demand for additional manufacturing equipment for the production of products normal to our domestic trade is assuming proportions no longer negligible by builders of machinery. Special efforts are being made to accommodate the most urgent needs of customers and it is understood that special delivery promises are being made in exceptional cases. At the same time the general delivery situation continues unresponsive. The effort made by the Bethlehem Steel Company to replace the equipment ruined in the recent burning of one of its shops has been felt even in this territory where some machines have been taken from stock. In Chicago it is stated that the demand for factory space is out of all proportion to the available supply of vacant buildings. Recent purchases by the Haynes Automobile Company, Kokomo, Ind., are said to have totaled $50,000, while another sale of tools at Chicago approximated $10,000. The Chicago & Northwestern Railway is taking prices on a small list of tools, and the Illinois Central still has some equipment to buy.

The Link-Belt Company, Chicago, is erecting a two-story brick foundry, 87 x 121 ft., on West Thirty-ninth Street, to cost $30,000.

The Chicago Nut Company, 2513 West Twentieth Street, is building a plant, 91 x 178 ft., to cost $38,000, which it expects to have in operation by May, 1916.

The Illinois Malleable Iron Company, Chicago, will build a one-story brick factory, 40 x 107 ft., at a cost of $7,000.

The Fish Furniture Company, 400 North May Street, Chicago, is erecting a three-story brick factory, 77 x 99 ft., to cost $25,000.

The Evening American Publishing Company, 209 South Sangamon Street, Chicago, has had plans prepared for a garage and automobile repair shop, 100 x 125 ft., to cost $50,000.

The Scofield Heater Company, Bloomington, Ill., is planning the erection of a factory to cost $25,000.

The Pioneer Pole & Shaft Company, Cairo, Ill., is building an engine and boiler house and will install additional woodworking machinery.

The Bonner Drop Forge Company, Danville, Ill., has increased its capital stock from $5,000 to $750,000.

The Crawford Locomotive & Car Company, Streator, Ill., was sold at auction Nov. 26 for $95,000.

The Barker-Swan Film Company has started preliminary work for the erection of a moving picture plant at Peoria, Ill., to cost $50,000.

The Mutual Wheel Company, Davenport, Iowa, will erect an addition to its plant, to cost $10,000, to be used for the manufacture of automobile wheels.

The Lennox Furnace Company has sold its old factory and will build another unit to its new plant at Marshalltown, Iowa.

The Plymouth Cordage Company, Plymouth, Mass., has purchased property at Twenty-second Street and Piggott Avenue, East St. Louis, Ill., on which it will erect a four-story plant to cost approximately $100,000.

Oswego, Kan., will receive bids for waterworks improvements. The plans include a low service pump of 1,000,000 gal. a day, a boiler feed pump, etc. Albert C. Moore, Joplin, Mo., is the engineer in charge.

The Elgin, Joliet & Eastern Railroad has plans for a car repair and machine shop at Joliet, Ill.

A plant for the manufacture of matches is reported to be planned for equipment at Kankakee, Ill., by the Pan American Match Company, Worcester, Mass.

The T. W. Warner Mfg. Company, Muncie, Ind., has had plans made for the erection of two factory buildings which will cost $100,000.

Milwaukee

MILWAUKEE, WIS., Nov. 29, 1915.

A development of the local situation in the metal-working trades is the transformation of shops heretofore engaged on specialties to jobbing or commercial shops. The present prosperous and busy conditions have not affected every line to the same extent, and such shops as have unused capacity are going in for special work for shops that cannot take care of their own requirements. The result is that all shops are busy and all capacity is being utilized. Machine-tool builders are figuratively staggering under the tremendous load of business and one company reports that it has refused more orders in the last three months than it accepted in six months last year. The Allis-Chalmers interests have booked an order totaling $1,500,000 for large gas engines for the Steel Corporation's Gary plant. The average level in all Milwaukee metal-working industries is 90 per cent. Some concerns have increased their output 200 to 300 per cent. In Milwaukee labor trouble is absent, but agitation is going on with increased vigor. Individual companies are handling the demands of workmen as necessity arises, and in many cases are voluntarily adjusting wages and hours, which accounts for the quiet situation. No more skilled labor is to be had.

The Allis-Chalmers Mfg. Company, Milwaukee, confirms the report that it has been awarded a contract for gas engines by the United States Steel Corporation for installation in its new works at Gary, Ind. The contract is valued at $1,500,000, and it is stated that the order will not require increased equipment, although some men will be added to the working force as they are available.

The Gillette Safety Tire Company, a new Illinois corporation capitalized at $1,000,000 and with headquarters at Chicago, Ill., has practically determined to locate its permanent works at Eau Claire, Wis., and has selected the site of the former mills of the Northwestern Lumber Company for the proposed new works, which will cost about $55,000.

William Haese, formerly of Reedsville, Wis., has incorporated under the style of Haese Track Sander Company, with $100,000 capital and headquarters at Milwaukee, Wis. The officers are: President, Ferdinand Haese, Sr.; secretary, William Haese; treasurer, Adolph Haese.

Articles of incorporation have been filed by the Southern Wisconsin Electric Company, Lake Geneva, Wis. The capital stock is $100,000 and the corporators include John B. Sanborn, C. E. Blake and W. J. P. Aberg.

The Lake Breeze Motor Company, Chicago, Ill., has accepted a proposition from the chamber of commerce, Oshkosh, Wis., to make that city its permanent headquarters. The plant will be moved this winter and operations will be resumed at Oshkosh about April 1.

Julius and Harvey Edwin, Rhinelander, Wis., have purchased a site for a garage 40 x 120 ft., one story and basement.

The Silverkropp Engineering Company, Racine, Wis., is having plans prepared for a new factory and machine shop, one story, 50 x 100 ft., of brick and steel. E. B. Funston, Racine, is architect.

The Janesville Carriage Works, Janesville, Wis., is about to erect a one-story factory addition, 36 x 66 ft.

George F. Sanborn, Eagle River, Wis., is preparing to build a garage, 50 x 50 ft., one story.

The Farmers' Packing Company, Sauk City, Wis., has completed its organization and is preparing to spend $100,000 in the erection of a packing plant and power house. Contracts will be awarded about March 1. John Schneider is president.

P. O. Vivian, Mineral Point, Wis., has broken ground for a garage and machine shop, to be 50 x 80 ft., one story and basement, to cost $9,000.

Monticello, Wis., has voted $12,000 for a municipal electric lighting plant. Edward Blumer is mayor.

Cleveland

CLEVELAND, OHIO, Nov. 29, 1915.

The miscellaneous demand for machine tools in small lots continues active, and some good-sized orders are coming from consumers not working on war material. A local machinery house has booked about fifty machines, amounting to around $40,000, for an Ohio manufacturer of automobile parts and accessories, and another order placed in northern Ohio during the week was for fifteen machines. Automatic screw machinery is in good call from widely scattered sources and business is being booked for deliveries from July to September. Many inquiries are not resulting in orders, however, as earlier deliveries are wanted than makers are able to promise. The demand for forging machinery for locomotive and car shops and automobile plants is heavy. Manufacturers in almost all metal working lines are crowded with work and many are inconvenienced by inability to secure steel as needed. Numerous plant extensions have created a heavy demand for transmission equipment. Nearly all of the local jobbing foundries are operating at maximum capacity.

The Winton Engine Works, Cleveland, has placed contracts for the erection of a factory, 50 x 300 ft., of brick, steel and glass, which will be used mostly for assembling purposes. Plans have been prepared by Ernest McGeorge, engineer, Leader-News Building.

The W. S. Tyler Company, Cleveland, has had plans prepared for a brick and steel machine shop. Geo. S. Ryder & Co., Century Building, are the architects.

The Baker-Rauch & Rang Company, Cleveland, builder of electric automobiles, denied a report that it will erect a plant at Madison Avenue and West 117th Street. The site acquired at that location will be used by other interests.

Rollin H. White, formerly vice-president of the White Company, Cleveland, has purchased 38 acres in Euclid, Ohio, for the erection of a plant to manufacture farm tractors and other motor farm implements. The first unit will be erected shortly.

The American Multigraph Company, Cleveland, will erect a one-story brick and steel addition, 77 x 135 ft., to be used for storage purposes.

The Oster Mfg. Company, Cleveland, will erect a two-story and basement building, 35 x 88 ft., to be used for office purposes.

The Ajax Mfg. Company, Cleveland, has acquired a site adjoining its present plant and is having plans prepared for a brick and steel addition, which will be built shortly in connection with various changes to be made in its present plant.

The Horsburgh Forging Company, Cleveland, has acquired a site upon which it plans to erect a new forge shop, providing considerable increase over its present capacity.

The Up-to-Date Sheet Metal Company, Cleveland, has been incorporated by H. E. Bernhard, J. E. Prosser, Charles Miles, and others, with a capital stock of $10,000 to manufacture iron and steel and various products.

The Northern Blower Company, 4515 Storer Avenue, Cleveland, will erect a new factory. Plans are being prepared by the R. M. Hulett Company, Cleveland.

The C. E. Squires Company, Kelley Avenue, Cleveland, maker of steam specialties, will enlarge its plant.

It is announced that the Mason Tire & Rubber Company, which is being organized in Cleveland, will build a plant in Kent, Ohio, to cost $60,000.

The Tubeless Tire & Rubber Company, Millsburg, Ohio, has been organized to establish a plant for the manufacture of automobile tires.

The Model Foundry & Machine Company, Findlay, Ohio, has been incorporated with a capital stock of $25,000 by Anderson C. Heck, and others.

The Brightman Hammered Nut & Mfg. Company, Sandusky, Ohio, has moved into a new plant on Tiffin Avenue, which it remodeled. This provides room for extensions.

Cincinnati

CINCINNATI, OHIO, Nov. 29, 1915.

A total of 361 men went to work in different local shops last week, and there are no reports of desertions from the former forces. It is an interesting fact that the majority of local shops are working a larger number of men than they do in normal times. Night work has been resumed in the plant of the American Tool Works Company. The labor situation at Hamilton, Ohio, is slightly better. At Dayton, Ohio, there is no change, while both Springfield and Columbus report conditions as being about normal in spite of labor union efforts to cause trouble.

While there is yet considerable business to be obtained from Europe for single-purpose machines for finishing shrapnel cases, as well as from American firms, orders are being placed more cautiously and with stipulations that tend to deter many firms from engaging in the manufacture of lathes, who had made plans to do so. Machine-tool prices are admittedly on a higher level, but manufacturing costs have also gone up and the margin of profit commonly reported has been largely exaggerated.

The railroads are still holding back, although there have been a few orders placed for single tools lately. Woodworking machinery is improving. Portable electric drilling machines are still good sellers. The boiler and tank business is also good. The jobbing foundries are not quite as active as they were three weeks ago.

The Cincinnati Electrical Tool Company, Cincinnati, has increased its capital stock from $50,000 to $75,000. No plant extensions are planned now.

Plans have been completed for the proposed boiler house for the Ault & Wiborg Company, Cincinnati. It will be 44 x 115 ft., of brick construction. Automatic stokers will be installed.

A further addition to the plant of the Elmwood Castings Company, Elmwood Place, Cincinnati, is contemplated. The necessary equipment is only partially provided for.

The Triumph Electric Company, Oakley, Cincinnati, has been awarded contract for three 650-kw. generators to be installed in the new building of the Methodist Book Concern, Cincinnati.

L. L. Smith, Johnstown, Pa., has acquired a site in Ivorydale, Cincinnati, on which he will erect a planing mill.

The Champion Carbon Mfg. Company, Loveland, Ohio, has been incorporated with $30,000 capital stock by M. H. Thurnauer, and others. Manufacturing plans have not yet been given out.

Eichenberry Brothers, Hamilton, Ohio, will erect a grain elevator and warehouse on South Seventh Street.

The American Mechanical Toy Company, Dayton, Ohio, has acquired a site in Edgemont on which it will erect a factory next spring. Building details are not yet available.

Wasner & Wilkie, Batavia, Ohio, will enlarge their foundry. A 10-ton cupola will replace a 5-ton cupola.

The Robbins & Myers Company, Springfield, Ohio, will soon commence work on a factory addition for which approximately $50,000 worth of equipment will be required. The company manufactures fans and motors.

The Jeffrey Mfg. Company, Columbus, Ohio, has taken out a permit for a one-story steel shop addition to cost $6,000.

The American Milling Machine Company, Batavia, Ohio, has increased its capital stock from $10,000 to $12,000. Some extra equipment will be added.

The Wadsworth Aluminum Company, Wadsworth, Ohio, has been incorporated with $20,000 capital stock by W. C. Washburn and others.

Indianapolis

INDIANAPOLIS, IND., Nov. 29, 1915.

The Elwood Foundry, Indianapolis, has been incorporated with $10,000 capital stock by B. H. Campbell, Ernest G. Sotten and Lewis A. Coleman.

The Luminous Specialty Company, Indianapolis, has been incorporated with $10,000 capital stock to manufacture electric and other devices. The directors are C. S. Walker, W. G. Himmelwright and Fred S. Coulter.

The Safety First Devices Company, Indianapolis, has increased its capital stock from $25,000 to $50,000.

The Baker Specialty & Supply Company, Logansport, Ind., has increased its capital stock from $40,000 to $100,000.

The Indiana Metal Novelty Company, Vincennes, Ind., has been incorporated with $7,500 capital stock to make metal novelties. The directors are B. C. Amerine, G. A. Downey and J. E. Hartigan.

The American Fan Company, Indianapolis, has been incorporated with $10,000 capital stock to manufacture fans. J. H. Everitt, T. S. Meeker and H. P. Euler are the directors.

The Indiana Hollow Ware Company, Jeffersonville, Ind., has been incorporated by E. W. Abrams, J. G. Mott and J. H. Waterbotham with $50,000 capital stock to manufacture hollow ware.

The Hoosier Post Company, Terre Haute, Ind., has been incorporated with $20,000 capital stock to manufacture posts. The directors are J. R. Finkelstein, S. T. Greenberg and Isaac Plost.

William Seidel & Co., Elkhart, Ind., have incorporated with $15,000 capital stock to manufacture band and orchestra instruments. William F. Seidel, Jacob W. Geiss and Thomas G. Wilkinson are the directors.

The Dwiggins Wire Fence Company, Anderson, Ind., has increased its capital stock from $75,000 to $150,000 and made other changes in its securities.

The Hartman-Townsend Company, Indianapolis, has been incorporated with $5,000 capital stock to manufacture auto tops and other accessories. The directors are L. C. Hartman, D. Townsend and W. H. Fletcher.

Detroit

DETROIT, MICH., Nov. 29, 1915.

Dealers continue to report a good volume of orders for machine tools and equipment. While a large percentage of business is coming from the automobile industry and still more is for allied industries, almost all lines of the metal trade are contributing to the activity. Present conditions do not indicate any let up as inquiries are heavy. Jobbing machine shops are uniformly busy. The demand for engines and boilers, which has been good, has slackened noticeably. Building conditions are about normal for this time of the year.

The Searight-Downs Mfg. Company, Detroit, has been incorporated with $30,000 capital stock to do a general machinery business. The incorporators are Frank B. Downs, Charles T. Cutlip and John R. Searight.

The Stroh Brewing Company, Detroit, has taken out a permit covering the erection of a two-story ice manufacturing plant, 70 x 91 ft., to cost about $20,000.

The King Works, Inc., Detroit, has been organized with a capital stock of $10,000 to manufacture tools, dies, etc. The stockholders include Floyd C. King and Denton Guiness.

The Fisher Closed Body Company, Detroit, manufacturer of automobile bodies, is erecting a two-story mill building, 40 x 388 ft., to cost $50,000.

The Hupp Motor Car Company, Detroit, has completed negotiations for the purchase of the American Gear Mfg. Company, Jackson, Mich. It is stated the plant will not be removed to Detroit but that the present factory will be enlarged and improved.

The Detroit Pressed Steel Company, Detroit, manufacturer of steel stampings and automobile parts, has increased its capital stock foom $250,000 to $650,000. The company has enlarged its plant during the year.

The Victor Screw Works, Detroit, has been incorporated with $25,000 capital stock by George J. Lieber, Edward J. Chapin and Victor M. Gunderson.

A new company headed by Glenn H. Howe, Indianapolis, Ind., has acquired a factory at Muskegon, Mich., and will shortly place it in operation for the manufacture of automobile tire chains.

The Lindermann Machine Company, Muskegon, Mich., has begun the erection of a one-story addition to its plant, 31 x 153 ft., and will also increase the capacity of its power plant. It manufactures special metal-working machinery.

The Lakey Foundry Company, Muskegon, Mich., which is completing an addition to its foundry, has broken ground for a machine shop to be equipped with a 10-ton crane.

The Columbia Motor Truck & Trailer Company, Pontiac, Mich., has awarded the contract for a new plant, 60 x 200 ft., of modern construction.

S. Fair & Son, Saginaw, Mich., who operate a steel and iron foundry, have increased their capital stock from $20,000 to $75,000.

The Jackson Motor Parts Company, Jackson, Mich., incorporated with a capital stock of $210,000 to manufacture automobile engines, has taken over the plant of the Ruby Mfg. Company. L. E. Latta is president and general manager.

Fire in the machine shop and grinding department of the Packard Motor Car Company, Detroit, Mich., did about $4,000 damage, chiefly to machinery.

The Ypsilanti Reed Furniture Company, Ionia, Mich., will build an addition to its plant, 80 x 160 ft., five stories, of fireproof construction.

The W. K. Prudden Company, Lansing, Mich., manufacturer of automobile wheels, is constructing new kilns and has in contemplation a factory addition.

The Chamber of Commerce of Hastings, Mich., which is providing facilities for new industries, has a factory building that will be ready for occupancy Feb. 1. It has 25,000 sq. ft. of floor space. The present occupants will move into a larger building and will engage in the production of heavy machinery.

St. Louis

ST. LOUIS, MO., Nov. 29, 1915.

While there has been no improvement in the supply of machine tools available for munition work, activity in other classes of machinery has increased. A general industrial improvement affecting all classes of factories is indicated. In consequence, machinery dealers who are unable to fill certain classes of demand are turning their attention to the fields in which the supply of equipment is better. An interesting development of the shortage of machine tools developed in a bankruptcy auction of the equipment of the Germania Refrigerating Equipment Company at Belleville, Ill., last week. The plant of the company was very thoroughly provided with machinery for making refrigerating equipment. At the auction many machine-tool makers were represented and in a number of instances they bought back at a higher price machinery which they had originally sold the Germania Company. There has been no let-up in the demand for lathes and similar machinery. Delivery dates are even more extended than at last report.

The Hayward Wrench Company, St. Louis, Mo., has been incorporated with a capital stock of $100,000 by Hubert H. Hayward, Springfield, Mo.; Homer Hayward and Lewis T. Dunaway, of Dadeville, Mo., to manufacture combination wrenches.

The Cutter-Schneider Machine Company, St. Louis, Mo., has been incorporated with a capital stock of $12,500 by Charles C. Schneider, James H. Cutter and Ida Hukemeier and will manufacture cloth-laying machines.

The Utahna Development Company, St. Louis, Mo., has leased an additional building at 1208 South Eighth Street, and will install equipment for the manufacture of electric washing machines.

The plant of the Southern Wheel Company, St. Louis, at Spring Avenue and the Wabash tracks, was destroyed by fire, the pattern and machine shop loss aggregating about $50,000.

The Missouri Iron & Metal Company, St. Joseph, Mo., has asked permission to issue $215,000 of bonds for machinery and other extensions.

The Missouri Iron & Steel Company, St. Joseph, Mo., has been incorporated with a capital stock of $15,000 by Henry Epstein, H. Wolesky and J. Adler and will engage in the scrap-metal business.

An assembling and service plant with machine shop, etc., to cost about $100,000, is being established at Kansas City, Mo., by the Studebaker Corporation.

A franchise for a public service electric plant at Schell City, Mo., has been awarded to E. T. Hartje, 2437 Independence Avenue, Kansas City, Mo., who is in the market for about 50 hp. equipment, estimated to cost $6,000.

At Poplar Bluff, Mo., under the direction of the Fuller-Coult Engineering Company, Chemical Building, St. Louis,

Mo., water tubular boilers, feed pumps, heater condensers, two 300-hp. uniflow engines, electric generators, etc., are to be installed in the electric light plant to cost about $50,000.

The Trenton Gas & Electric Company, Trenton, Mo., will remodel its gas plant, installing electric generators and fuel-oil engines and also equip an ice plant at a total cost of about $61,000.

The Hannibal Wire Fabric Company, Hannibal, Mo., will erect four new buildings and will install wire weaving machinery, additional power equipment, etc.

The Quaker Mineral Paint Company, Kansas City, Mo., has increased its capital stock from $30,000 to $50,000 for the purpose of adding to its equipment.

A part of the plant of the Bodiceau Lumber Company, Stamps, Ark., has been burned with a loss of about $200,000.

The Farm Engineering Company, Sand Springs, Okla., will equip a plant for the manufacture of tractor engines, etc. A. J. and O. G. Patch are in charge.

James R. Armstrong, Newkirk, Okla., representing outside capitalists, will equip an oil refinery with about 3500 bbl. daily capacity, at an estimated cost of $250,000.

The Fort Smith & Western Railroad is reported to have plans for the equipment of car and machine shops as well as terminals at Oklahoma City, Okla. W. E. Welch, Fort Smith, Ark., is superintendent.

Clarksdale, Miss., will receive bids until Dec. 14 for one 350-hp. water tube boiler, one 500-hp. open feed-water heater, one centrifugal boiler feed pump with motor drive, one motor-driven waterworks pump, and considerable other equipment. M. W. Purnell is city clerk.

The Yarborough Rotary Stalk Cutter Company, Shreveport, La., incorporated with $50,000 capital, will equip to manufacture rotary stalk cutters. Bird Brothers, Ward Building, should be addressed. Herman R. Strube and T. E. and John Bird are also interested.

The Ouachita Stave Company, Monroe, La., has been incorporated with a capital stock of $16,000 by Sam B. Meek, Warren, Ark., John J. Potts, Monroe, La., and J. R. S. Meek, Warren, Ark., and will equip a plant for the manufacture of staves.

The Central South

LOUISVILLE, KY., Nov. 29, 1915.

November is closing as the best month of the year thus far. Recent business has come with a rush after the dull period of several months ago. New manufacturing projects and public service plants are coming out more frequently than for a long while. Manufacturers are operating overtime in many instances.

The Louisville Gas & Electric Company will begin work on its new central steam-heating system early in 1916, as the city of Louisville plans to create the franchise in December.

The sawmill of the W. N. Ritter Company, Lower Elk, Ky., was destroyed by fire last week with a loss of over $100,000.

The American Metallic Packing Company, Lexington, Ky., is in the market for a second-hand air compressor with a capacity of 300 cu. ft. per min.

The Isaacs & Baker Company, Berea, Ky., which was awarded a franchise for a street-lighting system there, will install a steam plant to generate 100 hp. at an estimated cost of equipment of $12,000.

The Allegheny Coke Company, Hellier, Ky., which is now operating 175 ovens, has announced plans for the installation of additional units.

Mayor Williams Salisbury, Ashland, Ky., has information regarding the establishment of a dye plant by New York interests, who are said to have purchased a 16-acre site and to have plans for a $600,000 plant.

J. M. Wheatley, Jr., Sardis, Ky., is planning the installation of an electric light plant. A gasoline engine will probably be the prime mover.

R. L. Jackson and R. M. Baker, Dixon, Ky., are a committee arranging for the installation of an electric light plant.

A. N. Mason, Paducah, Ky., will manufacture an automobile specialty. He has contracted with the East St. Louis Malleable Iron Works for the castings, and is equipping a shop to handle the machine work.

J. C. Preston, Glasgow, Ky., has begun the erection of a garage.

The Union Cedar Company, Auburn, Ky., is purchasing equipment for a wood-working plant. W. P. Wheeler is buyer.

The wood-working shop of Edward Carpenter, Mt. Eden, Ky., was burned recently with a loss of $3,000.

The Flemingsburg Light & Ice Company will increase its capital from $12,000 to $20,000, and install new equipment. It plans to extend its service.

James Love, Lexington, Ky., has leased the plant of the Eagle Casting Company, Winchester, Ky., and has appointed William Lyons manager.

The Rock City Auto & Storage Company, 169 Third Avenue, North, Nashville, Tenn., is asking for prices on a lathe, drill press, emery wheel, steam hoist, etc., for an automobile repair shop.

The J. B. Willis Mfg. Company, Morristown, Tenn., will establish a plant for the manufacture of concrete blocks and silo material.

The United States Cast Iron Pipe & Foundry Company will build and equip an addition to its machine shop at its plant at Chattanooga, Tenn., for the manufacture of flanged pipe and fittings.

The Hitt Lumber Company, Decatur, Ala., will establish a planing mill at Chattanooga, Tenn. H. H. Hitt is president.

The Marion Extract Company, Marion, Va., has bought a ten-acre site in Chattanooga, Tenn., and will erect a plant to cost $150,000 for the manufacture of tannic acid. Construction work will begin at once. William H. Teas is president.

The Tennessee Power Company, which has headquarters in Nashville, Tenn., is preparing to electrify a six-mile steam road from Ocoee to Parksville, Tenn.

C. W. Barnes, Keysville, Va., is asking for prices on a 35-hp. portable boiler, with a 30-hp. engine. A sawmill outfit is also to be purchased.

Birmingham

BIRMINGHAM, ALA., Nov. 29, 1915.

The wholesale machinery trade has not been as active the past two weeks as previously. The volume of business, however, is satisfactory. There has been an especially heavy call for cornmills and sawmills. The activity of the lumber trade is felt increasingly.

The Southern Munitions Corporation, recently organized in New York City under the auspices of the Alabama Power Company, has leased the idle shops of the Illinois Car Company at Anniston, Ala., and it is announced that the plant will be at once converted into a munitions factory, starting with an order for 50,000 shells, or about $1,000,000 worth. The Anniston Ordnance Mfg. Company is to be organized to operate the plant. The Alabama Power Company, through F. H. Chamberlain, Birmingham, general manager, also announces the immediate construction at Anniston of an electric steel furnace at an initial cost of $100,000, and later to be enlarged. It is proposed to make both industries permanent. James Mitchell, 120 Broadway, New York, is president of the Alabama Power Company, which is at the head of both enterprises.

The Hallett Mfg. Company, Mobile, will rebuild its hardwood plant recently burned at a loss of $30,000.

The Lauderdale Power Company, Florence, Ala., has let a contract to the Allentown Engineering Company, Florence, to construct a hydroelectric plant on Cypress Creek at an estimated cost of $130,000.

C. E. Frost, First National Bank, Athens, Ala., is among those interested in the establishment of a plant at Birmingham to manufacture rubber automobile tires. A capitalization of $500,000 is mentioned.

The Nichols Grate Radiator Company, Atlanta, Ga., will manufacture grate radiators.

S. Sherman and C. Kennison, Sanford, Fla., will build a plant for the manufacture of tugs, barges and launches.

The Bladen Mfg. Company, Bladenboro, N. C., will erect a cottonseed oil mill at a cost of $50,000.

The damage to the shops of the Norfolk Southern Railway at New Bern, N. C., by fire recently, will be in the neighborhood of $35,000, of which about $12,000 was done to the buildings. The destruction of the shops will have little or no effect on the other shops of the railroad except while being repaired. The railroad will not move them to Norfolk. Only the coach and paint shops were left undamaged. Three main buildings were burned, including the roundhouse, engine house, machine and woodworking shop. F. L. Nicholson, Norfolk, Va., is chief engineer.

The Pacific Coast

PORTLAND, ORE., Nov. 23, 1915.

Conditions are regarded as favorable for a general resumption of activity on the Pacific coast. With the exception of lumber, all important products of this section are now in strong demand at profitable prices, and the lumber market is rapidly getting into better shape; while general financial conditions would seem to favor an early renewal of investment in development work. Railroad as well as shipbuilding shops are now quite busy, and the general shop and foundry trade is improving. Buyers do not like to place orders for machine tools for distant delivery, especially at the prices now asked, but some business is being closed. Mining and smelting operations continue to increase, giving rise to business in many lines of equipment. There is also considerable foreign business, though the machinery exported is mostly of Eastern origin.

Arrangements have been made for the handling through the port of Seattle, Wash., of 650 carloads of knocked-down freight cars for delivery to the Siberian Railroad at Vladivostok.

The Pacific Coast Company is converting five more of its steamers into oil burners. This involves considerable work, including the construction of fuel tanks and extensive alteration of the boiler arrangements.

The Galigher Machinery Company, Salt Lake City, Utah, has shipped fourteen filter presses to Java, for use in a sugar refinery.

The Port of Seattle will take bids Dec. 15 for a lot of refrigerating and electrical equipment for improvements at the East Waterway Terminal.

Reports from Aberdeen, Wash., indicate considerable railroad construction by logging interests around Grays Harbor, with indications of a general increase of mill operations in the near future.

The Washington Steel & Iron Company, Leavenworth, Wash., is preparing to build a new 10-ton furnace.

At a recent convention of sugar-mill engineers at Honolulu, H. T., general approval was given to the proposal to gradually replace steam by electricity as power for sugar mills.

Cannery owners are buying heavily to equip their plants for the heavy pack of 1916 that is expected. Men in this line predict that business will increase 50 per cent next year.

The Cement Pipe Machinery Company, Tacoma, Wash., was recently incorporated by A. F. Hammond, R. E. Fridlund and F. C. Neal, with a capital stock of $5,000.

A one-story brick and concrete machine shop will be built in Seattle, at 1506 Eleventh Avenue, by John Bacchus. The shop, with equipment, will cost about $4,500.

The Hicks-Bull Machine Company, Tacoma, Wash., was recently incorporated for $5,000 by J. J. Hicks, O. H. Bull and J. G. Lampson.

The Western Auto Company, Bremerton, Wash., is negotiating for a site to construct an automobile assembling plant. It is backed by George L. Grant, of the Grant Machine Works, Seattle, and C. A. Cawley, Bremerton.

The A. & G. Mfg. & Scales Company, Seattle, has been incorporated by A. L. Generaux and John Espen with a capital stock of $250,000. It is understood the company plans the construction of a plant.

Arco, Idaho, has granted to R. W. Ferris of that city, a franchise to install an electric light and power plant and waterworks system. Work on the electric light plant will commence before Dec. 1.

The properties of the Rathdrum Electric Company, Rathdrum, Idaho, have been purchased by Ralph Y. Poole, Ouray, Colo. The new owner plans to overhaul the plant and make necessary improvements.

The National Canning Company, Olympia, Wash., plans the installation of equipment and machinery which will more than double the capacity of its plant.

The Peasley Lumber Company, Lincoln, Wash., has recently secured a site and plans the construction of a planing mill and box factory.

The American Can Company plans the construction in Vancouver, B. C., of a brick addition to its factory in that city, four stories, 125 x 130 ft. M. Bigger is local manager.

The E. I. Dupont De Nemours Powder Company, Tacoma, Wash., plans improvements to cost about $40,000. I. J. Cox is superintendent.

Articles of incorporation have been filed for the United States Auto Gate Mfg. Company, Tacoma, Wash., with capital stock of $50,000. It plans the construction of a plant at Sequim, Wash., for the manufacture of an auto gate.

Texas

AUSTIN, TEX., Nov. 27, 1915.

The machinery and tool trades generally are unusually brisk and the development of new oil fields, particularly near San Antonio, is causing a demand for drilling and pumping machinery. Business with Mexico is improving.

The Dry Climate Tire Company, Denver, Colo., plans to establish a branch plant at El Paso for the manufacture of casings and inner tubes for automobiles and bicycles.

The Rio Bravo Irrigation Company, Rio Bravo, Mexico, is preparing to resume the construction of its irrigation plant. F. H. Carson, San Antonio, Tex., is engineer.

The Coconino Water Development & Stock Company, recently organized with a capital stock of $100,000, and principal office at Phoenix, Ariz., plans to develop a water supply near Flagstaff, and to distribute it by means of a pumping plant to stations on the Santa Fe Railroad between Ash Fork and Angel, as well as to towns on the rim of the Grand Canyon. C. H. Spencer is interested.

Portland, Tex., will issue bonds for the construction of an electric light plant. John W. Willacy, San Antonio, can be addressed.

The Dallas Union Terminal Company, Dallas, will erect a boiler-house, turntable, toolhouse, terminal service house, etc., to cost in the aggregate about $100,000.

Johnson & Moore will build a garage and machine shop at Floresville.

It is announced that the Houston Oil Company, Baltimore, Md., has arranged for an addition of $2,000,000 to its capital stock which will be used in developing its extensive oil and timber lands in east Texas.

W. H. Biggs, Womble, Ark., and associates, have formed the Sabine Stave Company and will install a plant at Beaumont, Tex., for the manufacture of staves.

The La Feria Mutual Canal Company, Brownsville, will enlarge its irrigation plant and extend its canal system, at a cost of about $150,000.

The Texas Fixture & Refrigerator Company, Fort Worth, will build a plant at El Paso for manufacturing refrigerators. Brown White is president and manager.

The Morrison Tie Plate Company has been organized at Texarkana to manufacture railroad tie plates. O. P. Morrison is interested.

Canada

TORONTO, Nov. 27, 1915.

Never before have steel companies been operated under such pressure. Every man available and capable of working is eagerly sought. The demand for steel is so urgent that some companies are forced to decline orders. Factories are busy, almost all working overtime.

Messrs. Kennedy, Owen Sound, Ont., will take over the idle Northern Iron & Steel plant at Collingwood, Ont., and will have it overhauled at once.

The Ontario Cartridge Company, Ford City, Ont., will take over the property formerly occupied by the Steel Products Company. It will be used for the manufacture of cartridges, for which the company has received a contract for 1,000,000. About 80 hands will be employed at the start, and more later when complete equipment shall have been installed.

Sawmill machinery will be purchased by Eben Lewis, Salisbury, N. B.

The Hardware Specialties, Ltd., will build a factory at Pembroke, Ont.

A large number of buildings belonging to the plant of the Canadian Explosives, Ltd., at Parry Sound, Ont., were destroyed by explosion.

George Davie & Sons, Levis, Que., has received a contract for the construction of a railroad-car ferryboat for British Columbia to cost $400,000.

The Porcelain Kitchen Furniture Company, Hespeler, Ont., will build a factory.

Work will be started in the spring on an addition to the Ford Motor Company's plant on Waterloo Street, London, Ont.

George Guentzler, Berlin, Ont., will build an addition to his wood-working plant.

The Ford Motor Company, Ford City, Ont., has purchased a site for the erection of a tractor manufacturing plant. Mr. McGregor is manager.

The Perfect Machinery Company, Galt, Ont., will build a machine shop to cost $4,000. S. H. Clark is manager.

Toronto will install a new boiler to cost $1,675 at the civic abattoir. Mr. Chisholm is commissioner.

The Waneta Development Company, Waneta, B. C., will construct a hydroelectric power plant at the Columbia and Pend O' Reille Rivers, B. C., to have a capacity of 80,000 hp.

Labeth, Ont., will construct a pumping house and will install new machinery.

Two motors to cost $5,000 will be installed at the waterworks, Galt, Ont. Joseph McCartney is clerk.

The George H. Beton Lumber Company, London, Ont., will install electrical equipment in its plant to operate woodworking machinery.

The Wallaceburg Brick Company, Wallaceburg, Ont., will erect an addition to its plant and will install machinery for the manufacture of tile, etc.

The Steel Company of Canada, Hamilton, Ont., is doubling its capacity.

The Star Films, Ltd., Montreal, has been incorporated with a capital stock of $1,000,000 by Francis H. Norman, Rupert G. Sharp, Herbert Lubin, and others, to manufacture motion-picture machines, films, etc.

The Gres Falls Development Company, Ltd., Montreal, has been incorporated with a capital stock of $10,000 by Gordon W. MacDougall, Lawrence Macfarlane, James G. Cartwright, and others, to build power plants, etc.

The Canadian Briscoe Motor Company, Ltd., Brockville, Ont., has been incorporated with a capital stock of $200,000 by Alfred O. Heather, Thomas J. Storey, James D. Smart, and others, to manufacture automobiles, etc.

The Canadian Lockers, Ltd., Toronto, Ont., has been incorporated with a capital stock of $100,000 by Thomas S. H. Giles, 47 Afton Avenue, Toronto, Harry Riley, John S. Duggan, and others, to manufacture safety deposit vaults, metal goods, etc.

The H. B. McCarthy Company, Ltd., Toronto, has been incorporated with a capital stock of $40,000 by James C. Allan, William A. McCarthy, George M. Moore, and others, to manufacture leather goods, etc.

The Ideal Foundry & Hardware Company, Ltd., Toronto, has been incorporated with a capital stock of $50,000 by Arthur E. Furniss, 667 Pape Avenue, Toronto; Robert M. Yeomans, Bertram Macdonald, and others, to manufacture machinery, war munitions, tools, etc.

The Auto Parts Repair Company, Ltd., Toronto, has been incorporated with a capital stock of $40,000 by Nathan Caplan, 237 Augusta Avenue; Joseph Layevsky, and others, to manufacture automobile accessories, etc.

The Canadian Crow Motor Company, Ltd., Mount Brydges, Ont., has been incorporated with a capital stock of $100,000 by Joseph K. Kidd, Edward R. Bond, George Lowthian, and others, all of Caradoc, Ont., to manufacture automobiles, etc.

The Brandon Shell Company, Ltd., Toronto, has been incorporated with a capital stock of $100,000 by Harold W. Shapley, William B. Milliken, Gordon McLaughlin, and others, to manufacture munitions, etc.

The Cheney Co-Operative Waterworks Company, Ltd., Cheney, Ont., has been incorporated with a capital stock of $1,500 by Edouard Gendron, Charles LeFebvre, and others, of Clarence, Ont., to build and operate waterworks, etc.

The Ontario Hydro-Electric Commission will build a plant at Muskoka Falls, Ont., to develop 1000 hp. G. A. Gaby, Continental Life Building, Toronto, is chief engineer.

D. W. Abrahamson's sash and door factory at Revelstoke, B. C., was destroyed by fire with a loss of $20,000.

E. Ketchalaw, Eden, Ont., is in the market for woodworking machinery.

The Multipress Company, Ltd., 67 Richmond Street East, Toronto, is in the market for drop hammer and screw presses.

The Willys-Overland Automobile Company is contemplating the erection of a factory on Weston Road, Toronto. Thomas A. Russell is vice-president.

Cornwall, Ont., will purchase a new pump and make extensions to its waterworks system to cost $25,000. J. G. Harkness is clerk.

Government Purchases

WASHINGTON, D. C., Nov. 29, 1915.

Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, until date not set, schedule 9051, for one double emery grinding machine, one 21-in. drill press, two 36 and 38-in. band saw, one 16-in. universal saw and one single surfacing machine, all for Portsmouth.

The general purchasing officer of the Panama Canal, Washington, D. C., will receive sealed proposals until 10 a. m., Dec. 13, for motor-driven centrifugal pumps, etc.

NEW TRADE PUBLICATIONS

Buffing, Polishing and Burnishing Machinery.—Munning-Loeb Company, Matawan, N. J. Bulletin No. 700. Describes a line of buffing and polishing lathes ranging from a small bench type to a large double-spindle machine with a pedestal. A separate page is given to each style of lathe with an engraving, brief description and table of specifications. Mention is also made of belt strapping and flexible grinding machines, tumbling and burnishing barrels and sand blast apparatus.

Railroad Construction.—Westinghouse, Church, Kerr & Co., 37 Wall Street, New York City. Bulletin No. 16. Calls attention to a record which was made in the building of a 12-mile railroad in less than five months at a total cost of considerably less than $150,000. A brief statement of the features of the work is given supplemented by views along the right of way.

Wire Cloth.—New Jersey Wire Cloth Company, Trenton, N. J. Pamphlet No. 1601. Points out the advantages of using copper wire cloth in place of bronze. A comparison of the properties of copper and bronze is presented and the results of tests made on copper and its alloys are briefly summarized.

Metallographic Laboratory Apparatus.—Scientific Materials Company, Pittsburgh, Pa. Booklet. Illustrations and descriptive matter explain the operation and use of a line of apparatus and supplies for the preparation of metal specimens for microscopic investigations. These include grinding and polishing machines and materials, hack saws and microscopes. Mention is also made of a warm air blast for drying etched specimens and a cabinet for storing them.

Measuring Instruments.—Shore Instrument & Mfg. Company, 555 West Twenty-second Street, New York City. Pamphlet. Mentions the use which can be made of two instruments for measuring the hardness and elasticity of rubber and other pliable materials. The way these instruments, which are known as the Durometer and Elastometer, are employed is described, and illustrations of the instruments in use and a chart of the results secured by them are presented. An illustrated description of these two instruments appeared in THE IRON AGE, June 24, 1915.

Feed Water Heater and Meter.—Harrison Safety Boiler Works, North Philadelphia Station, Philadelphia, Pa. Pamphlet entitled "Finding and Stopping Waste in Modern Boiler Rooms." Size, 6 x 9 in.; pages, 68. Devoted to the use and design of Cochrane meters for measuring feed water and condensate. The subjects of grade of fuel, grates, methods of firing, air leaks, control of draft, condition of gas passages, scale and soot on boiler tubes, radiation, etc., are taken up in the introductory part of the book. This is followed by a detailed description of the Cochrane metering heater, which is a combined open feed water heater and hot water meter, and its several modifications, together with the Cochrane flow recorder for use in connection with V-notch weirs. An illustrated description of the latter device appeared in THE IRON AGE, Aug. 5, 1915.

Cut-Off Valves.—Lagonda Mfg. Company, Springfield, Ohio. Catalog N-3. Calls attention to the function of the automatic cut-off valve which is designed to be placed between each boiler in a battery and the steam header, as well as the destructive results following steam header explosions where provision is not made for checking the flow of steam. The cut-off valves which are built with either external or internal dashpots are illustrated and described, followed by a description of a non-return valve of the internal dashpot pattern. In connection with all of these descriptions tables of dimensions of the different sizes of valves are presented and the descriptions are further supplemented by engravings showing various special arrangements of the valves and views of them in use in power plants.

Steam Engines.—Troy Engine & Machine Company, Troy, Pa. Catalog C. Lists a line of vertical and horizontal automatic, direct connected and throttling engines. Several types are illustrated and briefly described, the whole being preceded by a general description of the construction of the engine. Specification tables and an illustrated list of repair parts are included.

Air Compressors.—Gardner Governor Company, Quincy, Ill. Pamphlet. Refers to the various points that must be considered in an air compressor installation, such as the selection and location of the compressor, kind of air tank, pressure, speed, heat developed, etc. All of these discussed at some length and the text is supplemented by a number of engravings of the different types of compressors that can be supplied.